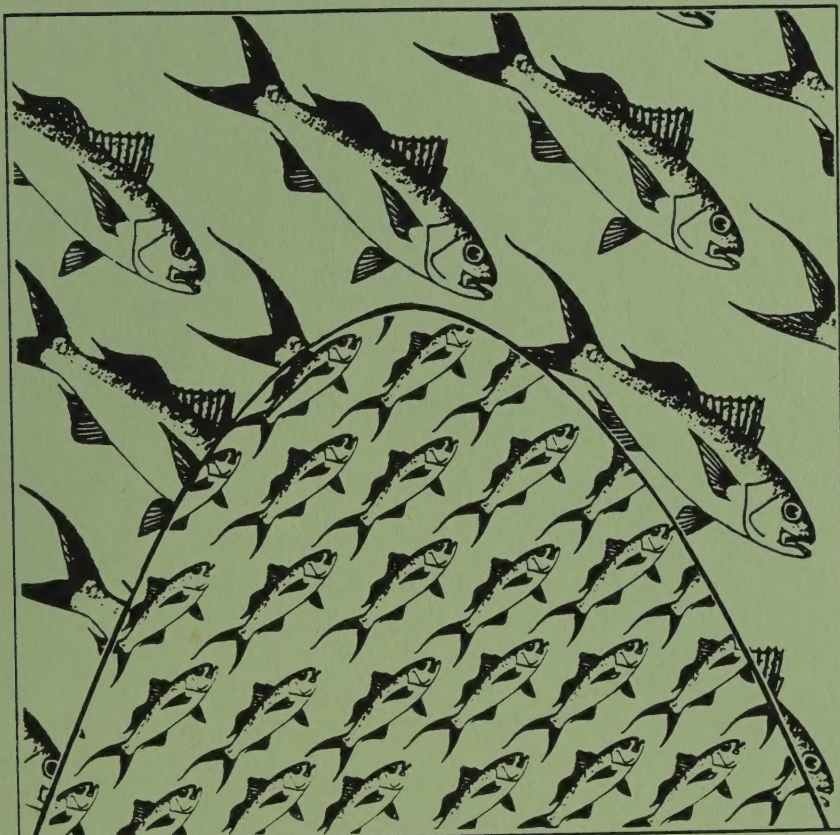


Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

1992 Annual Report



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August 1993

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Western Pacific Regional Fishery Management Council

Honolulu, Hawaii

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1.0 INTRODUCTION

The 1992 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken.

This year's report is organized slightly differently from previous years. A list of tables and figures has been added to facilitate ease of reference. The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any action that may need to be taken for each island area. Reports provided by respective fishery agencies from each island area then follow, detailing results of the year's descriptors and indicators, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. The report from each area concludes with a summary, which addresses progress made on the previous year's recommendations, and new recommendations. Finally, a series of appendices are included. These contain information on NMFS 1992 administrative and enforcement activities, habitat conditions, protected species interactions, and 1992 BPT membership.

Please refer to the bottomfish and seamount groundfish fishery management plan (FMP) for a list (Table 5.1) of bottomfish species names: scientific, common english, and local (American Samoa, Guam/Northern Marianas, Hawaii) names that are used in this report.

1.1 DEFINITION OF DESCRIPTORS

The fishery descriptors are defined as follows:

1.1.1 Landings Information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For Hawaii and the

Northern Marianas, landings information represents only the commercial harvest.

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). For the MHI, statistical tests for consistency in catch composition over time and between areas have been added this year. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 1992, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI bottomfish management unit species (BMUS) landings by species are provided for 1986 through 1992. No species-specific information is provided for the MHI fishery.

1.1.2 Effort Information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation Information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic Information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 DEFINITION OF INDICATORS

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is

available for SE Hancock Seamount for all years since 1985 (except 1992).

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for seven species in Hawaii. No mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for six major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI. SPR for armorhead was calculated annually from 1985-1991, but no data were available for 1992.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip).

2.0 AREA SUMMARIES

2.1 AMERICAN SAMOA

2.1.1 Descriptors

Bottomfish landings have been declining since 1988. This trend may be attributed to the following: the three hurricanes

that struck the territory (in 1987, 1990 and 1991), the departure of several highliners from the fishery, the shift in importance from bottomfishing to trolling, and the substitution of imported fish from Western Samoa and Tonga. The 1992 total landings decreased 27% compared to the previous year.

Fishing effort, measured by the number of trips and hours fished, declined in 1992 (24% less trips, 30% less hours than 1991 levels), largely due to the impact of the December 1991 hurricane. Prolonged periods of boat repairs resulted in the lowest number of vessels (14) landing bottomfish this year.

Prices have generally remained stable since 1986, with a steady increase in the past two years. In 1992, locally caught bottomfish were sold at higher prices than imported bottomfish species, indicating limited competition with fish imports.

2.1.2 Indicators

CPUE (pounds per hour) in 1992 was 71% of the baseline CPUE, indicating a healthy fishery. The estimate of the "worst case" SPR indicated that recruitment overfishing has not occurred in this fishery. Other indicator information (e.g., mean fish size, percent immature) should be available next year from a newly established program aimed at collecting size and maturity data from selected species. The drop in revenue per bottomfish trip reflects the decline in effort in 1992.

2.1.3 Recommendations

Available data do not indicate any problems with the bottomfish fishery or stocks in American Samoa. The BPT recommends that funding be continued for the program to collect length and maturity data and expand it to include additional BMUS. This information should permit SPRs to be estimated more reliably, with all data from American Samoa.

2.2 GUAM

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The total bottomfish landings decreased slightly (2%) in 1992 compared to 1991.

The number of trips taken also decreased (2,234 trips compared to 2,444 in 1991). Effort increased in 1991 following the opening of the Agat Marina, and the survey has been expanded to incorporate this marina.

The estimated number of boats participating in the bottomfish fishery has risen steadily over the past several years but remained constant from 1991 to 1992 at 173 boats.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is expected to have resulted from the seasonal supply of pelagic fish and difficulties in developing the marketing of locally caught fish. In addition, imported fish from other near-by areas has contributed to the continued marketing problem for local fishermen.

2.2.2 Indicators

The CPUE has fluctuated between 5-8 lb/hr, but has been fairly stable for the past seven years. No problem is indicated by CPUE.

The adjusted average revenue per trip does not appear to show any long-term trend of increase or decrease.

2.2.3 Recommendations

The 1992 data are not representative of the data analysis required for the bottomfish annual report. This resulted from the loss of the data processor. This deficiency jeopardizes both the integrity of the data and the funding of these important programs. The BPT recommends that this problem be rectified as soon as possible and that the 1992 data be analyzed sufficiently with the computerized expansion.

The need to complete a baseline biological survey for the red-gilled emperor still remains the major need for the Northern Marianas bottomfish resource. The BPT, therefore, again recommends that a joint program be established as a high priority to complete the survey.

2.3 HAWAII

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. Since that time there has been a steady decline in total landings, which finally appears to be stabilizing over the past three years. Landings in 1992 are slightly lower than pre-uku bonanza levels, but are 27% higher than the 1991 level. Estimates of both number of vessels and number of trips show a continued decline from 1988 peak values.

Total ex-vessel revenue from the MHI has also continued a general decline since 1988, mainly due to decreased landings.

However, inflation-adjusted average bottomfish prices have also been declining since 1990 (1992 is 9% lower than 1991).

NWHI Mau Zone: Mau Zone 1992 landings have decreased 31% from 1991. The total number of boats decreased by 43%, while the number of trips decreased by 35%. In addition, bottomfish landings per trip increased by 6%.

NWHI Hoomalu Zone: Hoomalu Zone 1992 landings have increased 25% from 1991. The total number of boats decreased by 25%, while the number of trips decreased by 21%. In addition, bottomfish landings per trip increased by 61%.

Available revenue data are not separated by zone. Total NWHI revenue has remained relatively stable since 1990, although inflation-adjusted average bottomfish prices have been decreasing slightly since 1990 (5%).

2.3.2 Indicators

MHI: CPUE increased in 1992 by 35% over the 1991 value, the first increase since the 1988-89 pulse associated with an uku bonanza. However, values from the last three years remain less than half that of the average of the first three years of data (640 lb/day, 1948-50), signifying a yellow light condition. The mean weight indicator remained difficult to interpret; however, most species of interest in the MHI have had a relatively stable mean weight. MHI onaga catch had the highest percentage of immature fish, and was the only species where the percent of the catch that was immature was consistently over 50%, signifying a yellow light condition.

The SPR indicator was calculated for six major species. SPR estimates for four of these species are above the 0.20 "critical" level used as an indication of recruitment overfishing. However, onaga SPR has been below 0.20 for three years based on new calculations this year. All SPR values increased slightly in 1992 (over 1991 values) due to the increase in aggregate CPUE. White ulua SPR in the MHI is probably underestimated, considering the findings of a NMFS study documenting the effects of a dual gear fishery. Corrected SPR values for this species will be forthcoming.

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1986 and by zone since 1988. The combined Mau Zone and Hoomalu Zone NMFS CPUE has been steadily decreasing since 1987, and the 1992 value is 72% that of the average of the first 3 years (739 lb/day, 1986-88). The Mau Zone NMFS CPUE has been decreasing since 1989, with the 1992 value decreasing 14% from the 1991 value. The Mau Zone HDAR CPUE has been decreasing since 1990, with the 1992 value 40% lower than the 1991 value and 36% that of the average of all trips within the first three years (5,817 lb/trip, 1948-50). Mean weights of

fish in the Mau Zone continue to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the catch was under 50% for all species evaluated.

The SPR values in the Mau Zone have been decreasing since 1990, mirroring the pattern in the HDAR CPUE. All values are presently above 0.30.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been decreasing since 1988, with the 1992 value decreasing 4% from the 1991 value. The Hoomalu Zone HDAR CPUE has been generally stable or slightly increasing since 1989, with the 1992 value 4% higher than the 1991 value and 83% that of the average of all trips within the first three years (6,879 lb/trip, 1948-50). Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the catch was under 50% for all species evaluated.

The SPR values in the Hoomalu Zone have been relatively stable since 1989, mirroring the pattern in the HDAR CPUE. All values are presently above 0.60.

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. CPUE, calculated from research longline catches, declined in 1991. The decline in CPUE, coupled with the absence of high "fatness index" armorhead in the catch, indicates that no recruitment occurred in 1991. There was no research assessment cruise in 1992.

SPR within the EEZ (S.E. Hancock Seamount) is approximately one percent, far below the threshold level for recruitment overfishing of 0.20. Outside the EEZ, where 99% of the known armorhead seamount habitat occurs, the SPR value was estimated at 0.07 for the last reported year, 1991.

2.3.3 Recommendations

For the NWHI, the BPT recommends that the new federal daily catch report (currently being developed) be implemented as soon as possible. Recommendations regarding possible modification of the NWHI limited entry program await the completion of the complete economic review of the fishery.

For the MHI, the BPT recommends that the State of Hawaii take immediate action to improve the recruitment overfished status of onaga stocks, and possibly other species, for the fishery which occurs predominantly in State waters. A three month seasonal closure is recommended. Minimum size as a management option for stressed bottomfish stocks is recommended against, due to suspected increases in mortality and wastage.

2.4 NORTHERN MARIANAS

2.4.1 Descriptors

Data are available only on the commercial fishery. The declining trend in landings (1988-91) was reversed in 1992. This is due to the slight increase in boats and trips for bottomfish.

The average price received for bottomfish dropped slightly to \$2.58, due to low landings of the high-priced export species. Total ex-vessel revenue to the fleet increased slightly in 1992.

Most effort was still being directed toward pelagic trolling. Most fishermen bottomfish only when the market for pelagic fish is saturated.

2.4.2 Indicators

The average bottomfish catch per trip increased by 26% in 1992. The average catch per trip is subject to significant biases (e.g., changes in trip length and relative amounts of bottomfishing compared to trolling). Because of this the catch per trip information is not a very good measure of CPUE. Unfortunately, CPUE is the only measurement readily available from the commercial landings data system. It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish species exclusively. While such a calculation may be sensitive to other biases due to small sample size, it should be investigated in the future. This indicator does not suggest the need for any management action.

2.4.3 Recommendations

The fishing community remained interested in bottomfishing in 1992, but technical knowledge is sparse. A bottomfishing training program is again recommended by the CNMI Division of Fish & Wildlife, with appropriate support provided by the Council. The program should include training in current equipment and techniques.

3.0 REPORT FROM AMERICAN SAMOA

3.1 INTRODUCTION

The bottomfish fisheries of American Samoa are typically one-day fisheries utilizing 28-foot aluminum catamarans (Alia) bought from the neighboring state of Western Samoa. During 1992, a total of 14 domestic boats landed bottomfish in the territory. All of these boats are owned by local residents who have full-time jobs with either the government or private companies, while employing full-time fishermen to fish their boats. Inflation-adjusted revenue for the fishery was estimated to be \$25,000 with virtually all the catch being sold locally. Boat-based fishing was mostly trolling and bottomfishing.

The people of American Samoa have harvested bottomfish from canoes for subsistence use over the millennia. But it was not until the early 1970's that the bottomfish fishery developed into a commercial venture using motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore commercial fisheries resulting in an abrupt increase in the fishing fleet and total landings. In 1982 a fisheries development project aimed at exporting high-priced deep water snappers to the Hawaii auction caused another notable increase in both bottomfish landings and revenue. Between 1982 and 1988, the bottomfish fishery comprised as much as 50% of the total commercial catch. Since 1988 the nature of the fishery has changed dramatically with a shift of importance towards trolling as revealed by a 63% decrease in bottomfish landings between 1988 and 1990. This was a result of the decrease in the number of full-time commercial fishermen who normally prefer the more profitable bottomfish method to trolling.

The effects of three hurricanes that struck American Samoa in 1987, 1990 and in 1991 can be seen in some of the trends in the fishery.

Since the onset of the Department of Marine and Wildlife Resources' (DMWR) offshore data collection efforts in the early 1970's, fisheries monitoring was done on Tutuila through an interviewing program of only commercial fishermen. With the assistance of the Western Pacific Fisheries Information Network (WPACFIN), a new sampling program which sampled commercial and recreational boats, was implemented in October 1985. In this creel survey, boats landing catches in designated areas were interviewed and their catches examined. For two weekdays and one week-end per week, DMWR data collectors sampled offshore fishers between 0500 and 2100 hours. Two DMWR samplers based on the Manu'a islands collect fisheries data from the Tau, Ofu and Olosega fleet.

3.2 DISCUSSION OF DESCRIPTORS

TABLE AS-1. American Samoa 1992 estimated total bottomfish landings.

Species	Pounds	Species	Pounds
Emperors (misc)	2034	Bottomfish (misc)	517
Redgill Emperor	1985	Gindai	345
Longnose Emperor	1805	Groupers (misc)	303
Jobfish	1775	Yelloweye Opakapaka	289
Bluelined Snapper	1210	Stone's Snapper*	43
Ehu	1012	Red Snapper	40
Lehi	741	Orangespot Emperor**	26
Lyretail Grouper	736	Tomato Grouper	22
Black Trevally	662	Jacks (misc)	14
Humpback Snapper	592		
Total Bottomfish:	14150		
Total BMUS :	11622		
* <u>Paraceasio stonei</u>			
** <u>Lethrinus kallopterus</u>			

Catches are weighed by species either at landing sites or during the selling of fish to the dealers. Because of the variability among years of the percent of the total sampled bottomfish catch that was identified to the species level, and because the bottomfish complex in American Samoa contains many more species (some important) than specified in the FMP, analyses of American Samoa's bottomfish data are for the whole complex, not just for BMUS.

There has been no significant change in the species composition of the bottomfish complex landed this year except the appearance of two species identified above. However, these two species were occasionally present in the landings of the past years but were not identified to the species level.

TABLE AS-2. American Samoa 1992 estimated average price of bottomfish species.

Species	\$/lb	Species	\$/lb
Black Trevally	2.44	Jobfish	1.96
Lehi	2.40	Redgill Emperor	1.94
Longnose Emperor	2.07	Gindai	1.92
Groupers (misc)	2.03	Yelloweye Opakapaka	1.90
Lyretail Grouper	2.02	Stone's Snapper*	1.90
Humpback Snapper	2.02	Bluelined Snapper	1.86
Ehu	2.01	Emperors (misc)	1.75
Bottomfish (misc)	2.00	Jacks (misc)	1.67
Orangespot Emperor**	2.00	Tomato Grouper	1.58
Red Snapper	2.00		
Bottomfish \$/lb:	\$1.98		
BMUS \$/lb :	\$1.96		
* <u>Paraceasio stonei</u> ** <u>Lethrinus kallopterus</u>			

Calculations: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. Average prices reported in this table are calculated by dividing the total revenue by the sold weight in pounds for each species.

Interpretation: Average prices of locally caught bottomfish species have been rising since 1989 and there appears to be no significant changes in species price distribution. The average price of bottomfish imported from Western Samoa was lower than that for local caught fish. Bottomfish imported from Tonga had a slightly higher average price, which may be attributed to freight costs. A healthy increase in average price from last year's price of \$1.80 suggests a revitalized fishery.

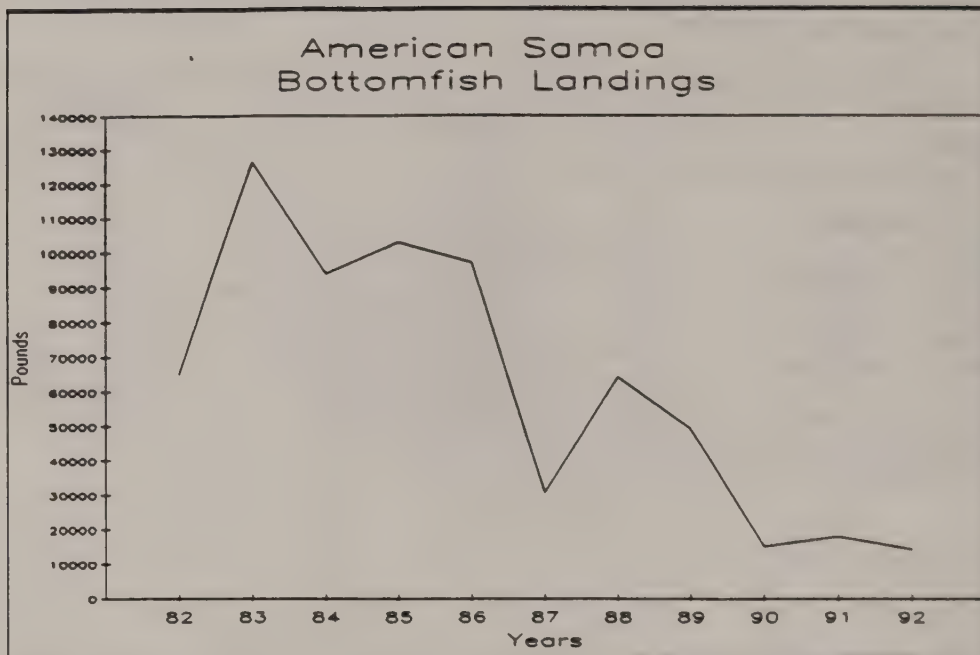


FIGURE AS-1. American Samoa bottomfish landings.

<u>Years</u>	<u>Bottomfish Landings (lb)</u>
1982	64,942
1983	126,327
1984	94,104
1985	103,114
1986	97,155
1987	30,640
1988	64,199
1989	49,279
1990	15,124
1991	17,934
1992	14,150

Calculations: Bottomfish landings for 1982-84 are calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and adding similarly adjusted Manu'a landings. The 1986-present landings are from the creel survey expanded species composition files (.SPC), which contain the annual estimated total landings by species for Tutuila, and then adding the adjusted Manu'a landings. Calculating statistics for 1985 is more complicated because the sampling program changed from commercial fleet sampling only to creel sampling on 1 October 1985. Monthly adjustments are made based on percent

coverage for January to September, then October to December .SPC files and the adjusted Manu'a data are added.

Interpretation: The substantial declines in landings in 1987 and 1990 were partly due to vessel losses caused by two hurricanes. The bottomfish fishery is much smaller in recent years than it was at any time between 1982 and 1986, a period where fishermen and a relatively large fleet were attracted to the profitable bottomfish export program. A slight increase in the 1991 landings is followed by the 1992 decrease, caused primarily by a hurricane that struck American Samoa in December 1991. Boat repairs were delayed as fishermen repaired or rebuilt their houses.

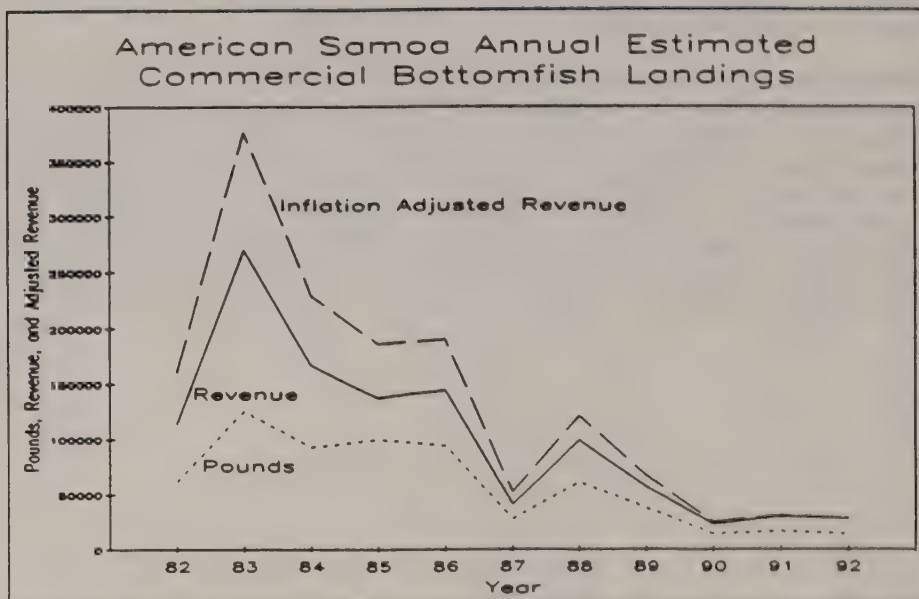


FIGURE AS-2. American Samoa annual estimated commercial bottomfish landings.

<u>Years</u>	<u>Commercial Landings</u>	<u>Revenues</u>	<u>Inflation Adjusted Revenues</u>
1982	62,016	113,678	160,172
1983	125,167	269,083	376,178
1984	92,841	166,917	229,010
1985	99,214	136,799	185,910
1986	93,712	144,077	189,605
1987	27,618	41,089	51,772
1988	61,212	98,333	120,163
1989	37,475	56,650	66,337
1990	13,751	22,753	24,733
1991	16,421	29,558	30,770
1992	13,994	27,668	27,668

Calculations: A relatively complex set of algorithms are used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short, the percent sold by fishing method is calculated monthly and multiplied by the percent species composition by month and then multiplied by the estimated total landings for that method and month.

Interpretation: During 1982-1985 sampling was done on the commercial fleet only (which then included nearly all the fishing boats), whereas since 1985 creel sampling has covered all boats

(commercial and recreational). Analysis of creel data for 1986-87 indicated that over 98% of landed bottomfish was still being sold. Therefore, it is believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Commercial landings mirror trends in the total fishery by showing declining catches in recent years. Relative to total landings, commercial landings decreased even more substantially in 1989 because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-88 to only 78% in 1989. The peak in 1983 portrays the high prices of deep water snappers exported to Hawaii, while the trough in 1987 can be attributed to the effects of the 1987 hurricane. The slight increase in the 1991 revenue was encouraging despite the continuous influx of imported bottomfish. This year, approximately 16,000 pounds of assorted bottomfish species were imported from Western Samoa and Tonga. The December 1991 hurricane contributed largely to the decreased landings and subsequent decrease in 1992 revenues. Unfavorable weather continued through May 1992, hindering commercial bottomfishing trips.

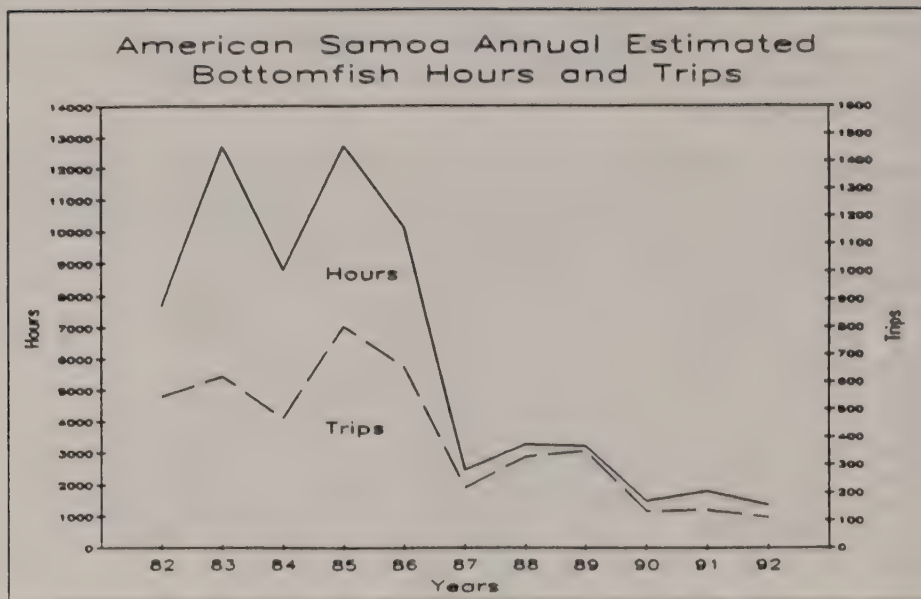


FIGURE AS-3. American Samoa annual estimated bottomfish hours and trips.

<u>Year</u>	<u>Hours</u>	<u>Trips</u>
1982	7,671	548
1983	12,695	621
1984	8,796	468
1985	12,740	804
1986	10,129	657
1987	2,458	217
1988	3,265	329
1989	3,215	349
1990	1,483	133
1991	1,798	136
1992	1,354	111

Calculations: The annual estimated effort (hours) spent bottomfishing is calculated by dividing the annual estimated total bottomfish catch by the average CPUE (pounds per hour) from trips fishing only for bottomfish. The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfishing trip. The average length of a bottomfishing trip (not shown) is calculated by using only trips which exclusively bottomfished and for which the trip

length was recorded. The total hours fished from those trips is then divided by the number of trips.

Interpretation: The sharp decline in the bottomfish landings since 1986 (Figure AS-1) is mirrored in Figure AS-3 by the sharp decline in level of effort. Rather than indicating a problem with the resource, this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable occupations. A meager increase in the number of trips and hours occurred in 1991, followed by a decrease in 1992, which can be attributed to the December 1991 hurricane that affected most bottomfishing vessels.

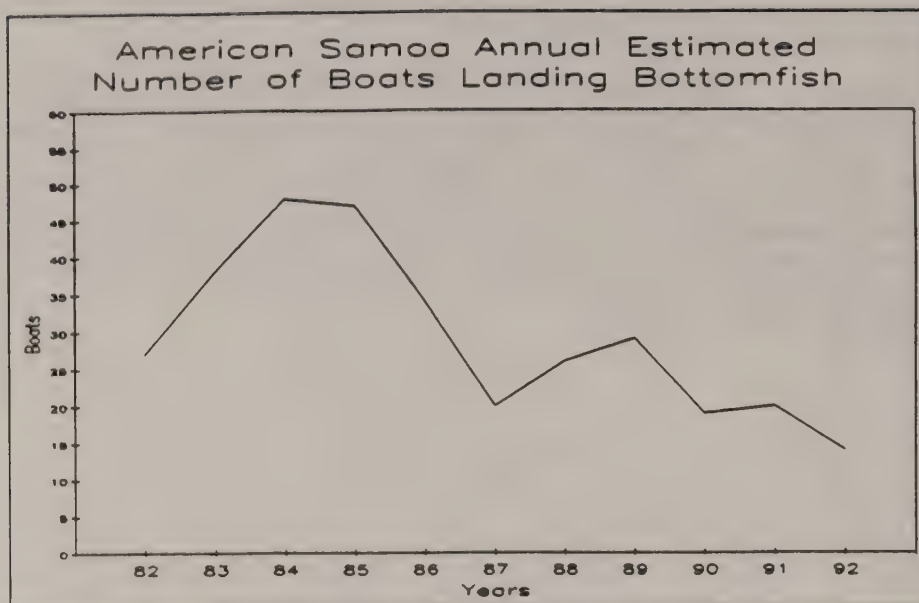


FIGURE AS-4. American Samoa annual estimated number of boats landing bottomfish.

<u>Years</u>	<u>Boats</u>
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	26
1989	29
1990	19
1991	20
1992	14

Calculations: The annual estimate of the number of boats in the bottomfish fishery is obtained by counting the unique boats which landed any bottomfish species that year.

Interpretation: Again, the decline in the fishery since 1985-86 is depicted by a decline in the number of participating boats. The 1987 hurricane caused the loss of the entire Manu'a fleet, plus some of the Tutuila fleet. Several boats which contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990 due to much needed repairs and their participation in non-bottomfish chartered trips. Unfortunately,

about 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the decline in 1992.

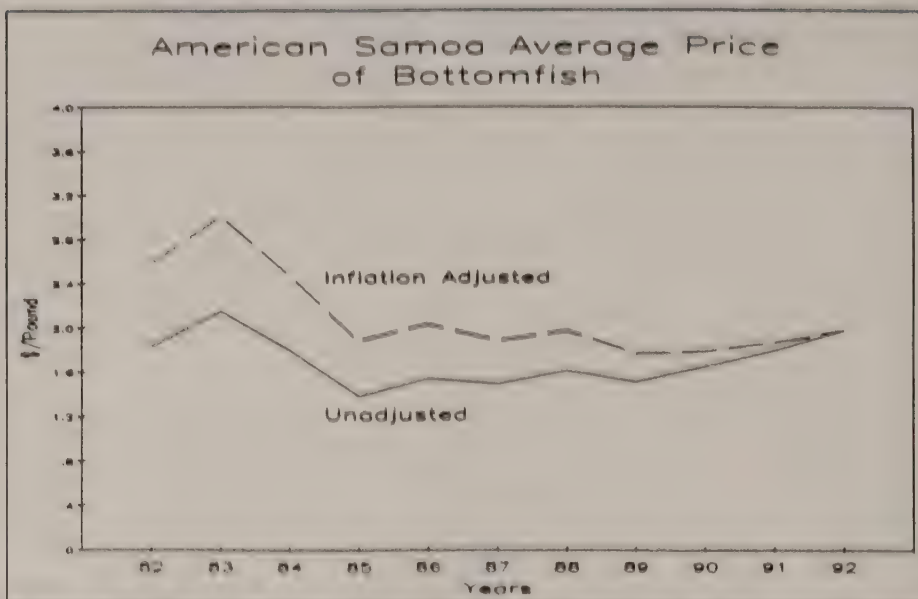


FIGURE AS-5. American Samoa average price of bottomfish.

<u>Years</u>	<u>\$/lb</u>	<u>Inflation Adjusted \$/lb</u>
1982	1.83	2.58
1983	2.15	3.01
1984	1.80	2.47
1985	1.38	1.88
1986	1.54	2.03
1987	1.49	1.88
1988	1.61	1.97
1989	1.51	1.77
1990	1.65	1.79
1991	1.80	1.87
1992	1.98	1.98

Calculations: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total weight sold. The inflation adjusted price is calculated by multiplying the unadjusted annual average price by the annually calculated consumer price index (CPI) for American Samoa using the current year as the base. For example, the CPI for 1991 was 135.3 and that for 1986 was 107.1. To calculate the inflation adjusted average price for 1986, multiply the unadjusted average price for 1986 by the 1991 CPI and divide by the 1986 CPI.

Interpretation: Prices were generally higher between 1982 and 1985, while high-priced deepwater snappers were exported to Hawaii. After this period, inflation-adjusted local prices have generally been stable. The steady increase in average prices since 1989 is a positive sign in light of the continuous importation of bottomfish species from Western Samoa and Tonga.

3.3 ANALYSIS OF INDICATORS

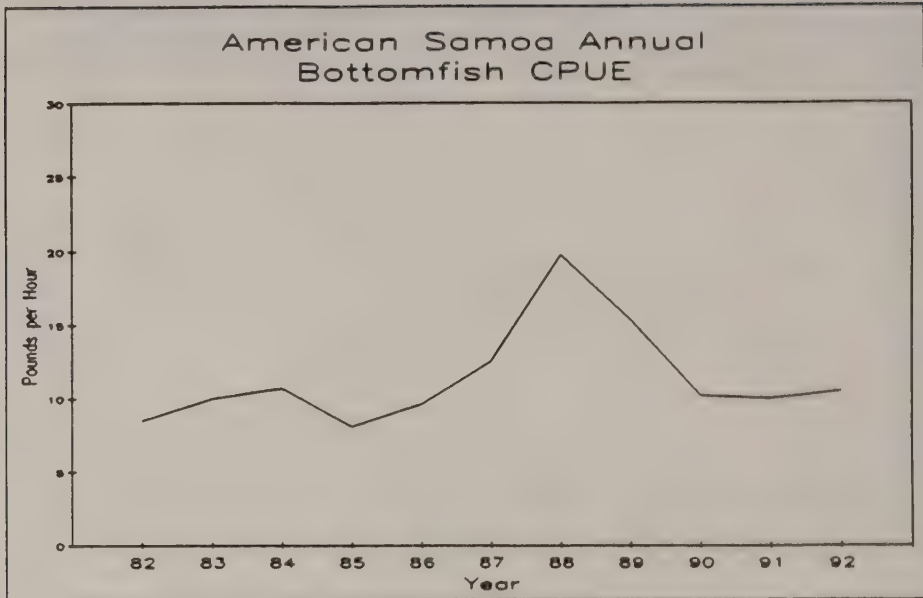


FIGURE AS-6. American Samoa annual bottomfish CPUE.

<u>Years</u>	<u>CPUE</u>
1982	8.5
1983	10.0
1984	10.7
1985	8.1
1986	9.6
1987	12.5
1988	19.7
1989	15.3
1990	10.2
1991	10.0
1992	10.5

Calculations: CPUE (pounds per hour) is calculated using trips which only bottomfished and recorded effort in hours. The average is calculated by using the CPUE from each trip as an observation and dividing by the number of trips.

Interpretation: The initial CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deep water snappers, which were exported to the lucrative Hawaii auction. A relatively high number of boats and local commercial

fishermen participated in the fishery during this period. The drop in 1985 and 1986 might be expected as a consequence of the rapid exploitation of a newly discovered bank. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1988 to 1990 can be partially attributed to a combination of some new inexperienced boats entering the fishery and the lower ratio of commercial to subsistence/recreational fishermen. CPUE has remained stable during the past 3 years, and is of similar magnitude to the first several years of the fishery.

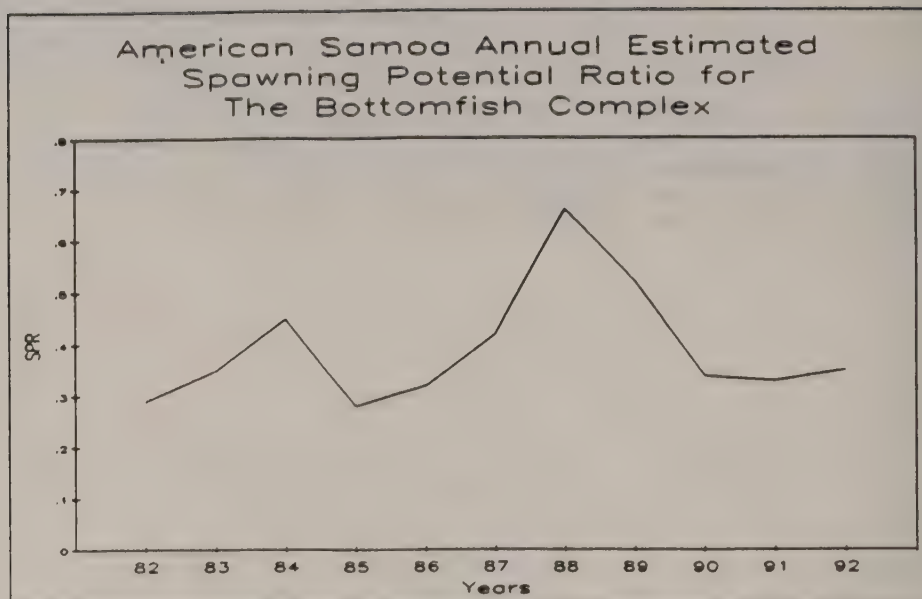


FIGURE AS-7. American Samoa annual estimated spawning potential ratio for the bottomfish complex.

<u>Years</u>	<u>SPR</u>
1982	.29
1983	.35
1984	.45
1985	.28
1986	.32
1987	.42
1988	.66
1989	.52
1990	.34
1991	.33
1992	.35

Calculations: The spawning potential ratio is calculated by dividing the current year's CPUE by the virgin population CPUE, then multiplying by the ratio of the current percent mature to the virgin population percent mature fish in the catch. To estimate SPRs for American Samoa, the "Dory" project mean CPUE for 1975 and 1976 combined (see BPT's 1990 Annual Report, page 20, Table AS-3) was used (due to the relatively complete and consistent raw data recorded during this period) to estimate virgin population CPUE (14.8 lb per hour). Since size and maturity data available for bottomfish in American Samoa are

insufficient, the ratio of percent mature in the catch was estimated by substituting the average of the 5 species which have the lowest SPR in Hawaii. In this manner a "worst case" SPR was calculated to provide what should be a very conservative estimate of SPR for the American Samoa bottomfish complex.

Interpretation: The proxy "worst case" SPR for 1992 was 0.35, significantly above the 0.20 critical level. According to this indicator, the bottomfish complex of American Samoa is not considered to be recruitment overfished. The absence of drops in SPR following hurricanes in 1987, 1990 and 1991 may indicate that these hurricanes did not impact local bottomfish stocks in a major way.

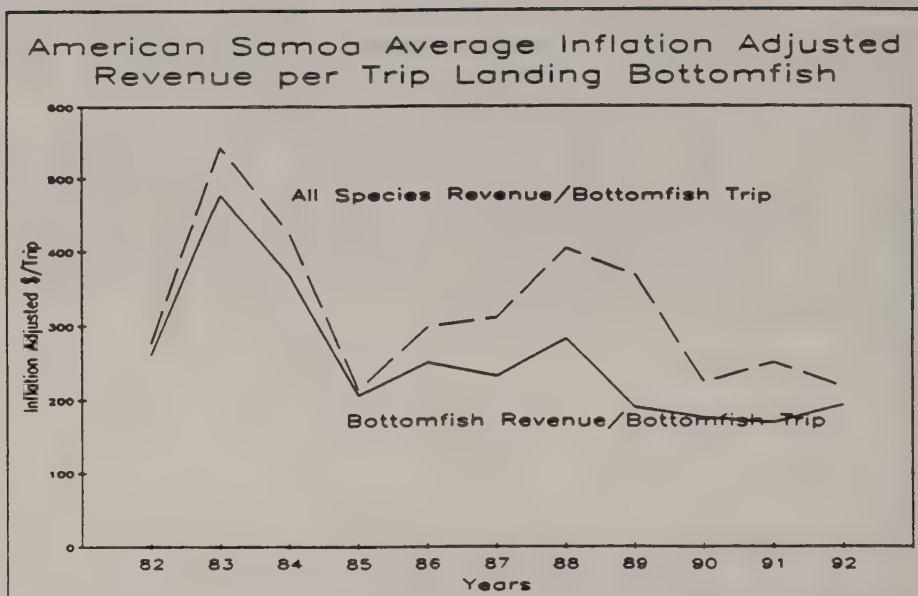


FIGURE AS-8. American Samoa average inflation-adjusted revenue per trip landing bottomfish.

<u>Years</u>	<u>Bottomfish</u> <u>Unadjusted</u>	<u>\$/Trip</u> <u>Adjusted</u>	<u>All Species</u> <u>Unadjusted</u>	<u>\$/Trip</u> <u>Adjusted</u>
1982	185	260	196	276
1983	341	477	388	543
1984	269	368	309	424
1985	151	205	157	213
1986	189	249	226	298
1987	184	231	246	310
1988	231	282	331	404
1989	161	189	315	368
1990	161	175	205	223
1991	161	168	240	250
1992	192	192	217	217

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all sales for any trip which landed any bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure AS-8 plots the inflation adjusted bottomfish and all species revenues per trip for the period 1982-1992.

Interpretation: The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers for export. Bottomfishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally declined since 1985, as most full-time commercial fishermen quit the fisheries. The supply of locally caught bottomfish has been supplemented by a significant quantity of imported bottomfish. The December 1991 hurricane affected most of the fishing fleet and resulted in the noticeable decrease in the number of boats bottomfishing (Figure AS-4). Annual revenue from this fishery consequently dropped.

3.4 SUMMARY

Generally, the fishery was smaller in the past several years than it was at any time between 1982 and 1986 (Figure AS-1). This reflects a trend in the loss of skilled fishermen, a shift to trolling and the availability of lower priced imported bottomfish. The December 1991 hurricane contributed to the 1992 decrease in landings (Figure AS-1) and the lowest number of trips ever recorded (Figure AS-3).

The CPUE (catch per hour) increased in 1992. The average bottomfish CPUE for the first 3 years of available data (1974 - 1976) was 14.8 pounds per hour. This year's aggregate CPUE (10.5 pounds per hour) was 71% of the historical base CPUE, indicating no severe signs of stress in this fishery. The estimate of the "worst case" SPR (refer to the analysis in Figure AS-7) indicated that recruitment overfishing has not occurred in this fishery.

DMWR acted on last year's first recommendation to collect size at maturity and length frequency data from key species. Samples of Lutjanus kasmira and assorted Emperors were bought from local fishermen at landing sites for this project.

Concern for the continuous decline in CPUE, mentioned in last year's recommendation, subsided as 1992 summaries depicted increases in both CPUE and SPR. The Bottomfish Plan Team (BPT) is in the process of refining these indicators and DMWR should continue to closely monitor the territory's fisheries utilizing these indicators.

3.5 RECOMMENDATIONS

Now that a program, recommended by the BPT, for the collection of length and maturity data has been initiated, DMWR should persist in the implementation and expansion of this program to include additional BMUS species in the near future. It is recommended that funds be obtained to continue this program

so that adequate data can be collected to produce meaningful results. Data on percent mature fish in the catch, obtained through this project, are required to calculate the SPR indicator more reliably, using data only from American Samoa.

4.0 REPORT FROM GUAM

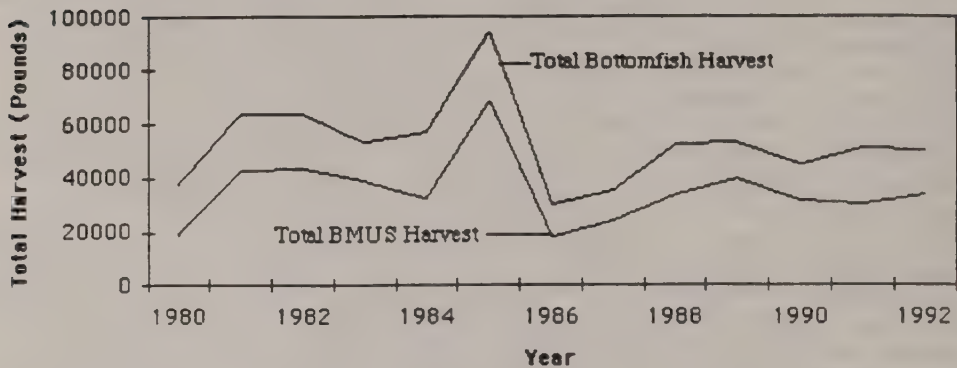
4.1 INTRODUCTION

Guam's bottomfish fishery is a combination small-scale, local, commercial and subsistence fishery. The majority of the participants are part-time fishermen who operate vessels less than 25 feet in length. Through the history of this fishery, fluctuations in annual harvest have been magnified by the consistent turnover in the few full-time highliner vessels. These vessels tend to be large, represent a major percentage of the effort expended in the fishery and impact the total annual harvest significantly. Guam has two distinct bottomfish fisheries which can be separated by depth and species. The shallow water fishery (100-500 feet) contributes a larger portion of the overall bottomfish harvest. This fishery targets the red-gilled emperor (Lethrinus rubrioperculatus), but also catches an assemblage of other snappers and groupers. The deep water fishery concentrates on the Pristipomoides snapper complex, focusing on the depths between 500 and 700 feet. Although Guam's bottomfish fishery has limited economic importance, the social importance carries strong cultural and subsistence values.

The Bottomfish Management Unit Species (BMUS) in Guam are: Cephalopholis urodeta, Epinephelus fasciatus, Variola louti, Caranx ignobilis, Caranx lugubris, Seriola dumerili, Aphareus rutilans, Aprion virescens, Etelis carbunculus, Etelis coruscans, Lutjanus kasmira, Pristipomoides auricilla, Pristipomoides filamentosus, Pristipomoides flavipinnis, Pristipomoides seiboldi, Pristipomoides zonatus, Lethrinus rubrioperculatus, Lethrinus amboinensis. For Table 1 Cephalopholis urodeta, Epinephelus fasciatus, and Variola louti comprise the grouper category; Caranx ignobilis, Caranx lugubris, Seriola dumerili comprise the jack category; and Lethrinus rubrioperculatus, and Lethrinus amboinensis comprise the emperor category.

4.2 DISCUSSION OF DESCRIPTORS

Guam Trend of Annual Bottomfishing and BMUS Harvest



Year	Total Bottomfish Harvest (lb)	Total BMUS Harvest (lb)	BMUS Harvest by Bottomfishing (lb)
1980	37,399	19,252	19,145
1981	63,654	42,517	42,443
1982	63,442	43,428	42,678
1983	53,404	39,193	39,193
1984	56,998	32,232	32,089
1985	94,318	68,141	65,941
1986	30,368	17,969	17,069
1987	35,053	24,288	17,069
1988	52,791	33,724	23,828
1989	53,272	33,724	32,750
1990	45,374	31,295	30,515
1991	51,329	29,962	28,289
1992	50,099	34,057	31,745

Figure G-1

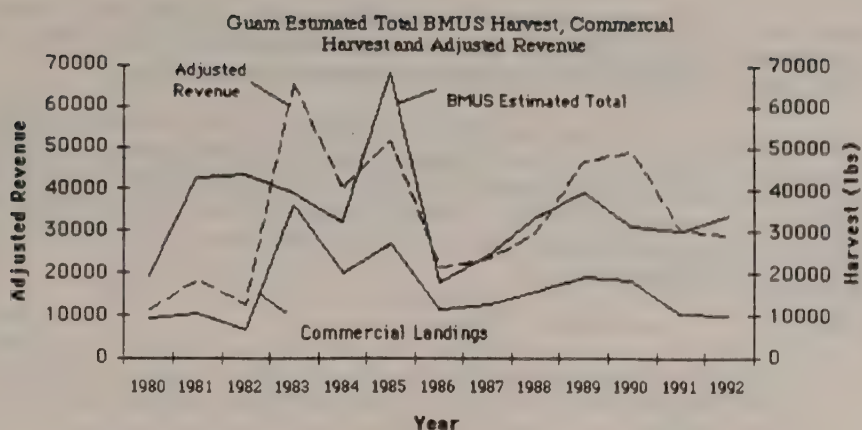
Source: The DAWR offshore creel survey data as expanded by computer based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings are selected from the creel survey expanded species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species code categories. These generic categories (e.g., mixed shallow bottom fish) also include some non-bottomfish species according to the FMP definition (e.g., squirrelfish).

Interpretations: The fairly radical fluctuations in bottomfish landings are due to fluctuations in the fishery, not the stocks. The 1985 peak and 1986 crash are predominantly due to a few highliner fishermen who fished in 1985 and not in 1986. The fluctuations in harvest between 1990 and 1991 may have resulted from the opening of the Agat Marina. Although boat trailer counts are taken at this facility the ratio of bottomfish participants to other methods is not known for this area and is expected to be higher than that at the Agana Boat Basin.

Table G-1. Guam 1992 creel survey composition of allocated bottomfish (lb).

Species	All Methods	Bottomfishing only
Grouper	4203	4185
Jacks	906	742
Lehi	332	332
Uku	4869	4806
Ehu	621	621
Onaga	157	157
Taape	1231	1231
Yellowtail Kalekale	4064	4064
Opakapaka	348	348
Yelloweye Opakapaka	402	402
Kalekale	21	21
Gindai	2613	2613
Emperor	7173	7173
Amberjack	199	178
Total	27139	26873



Year	Total BMUS Harvest (lb)	Commercial Harvest (lb)	Commercial Revenue (\$)
1980	19,253	9,381	27,947
1981	42,517	10,459	37,663
1982	43,428	6,617	24,545
1983	39,193	36,281	122,040
1984	32,232	20,115	68,782
1985	68,141	27,064	85,276
1986	17,969	11,482	34,168
1987	24,288	12,639	36,198
1988	33,724	15,792	43,199
1989	39,814	19,442	66,216
1990	31,295	18,390	59,465
1991	29,962	10,773	33,298
1992	34,057	10,344	29,410

Figure G-2

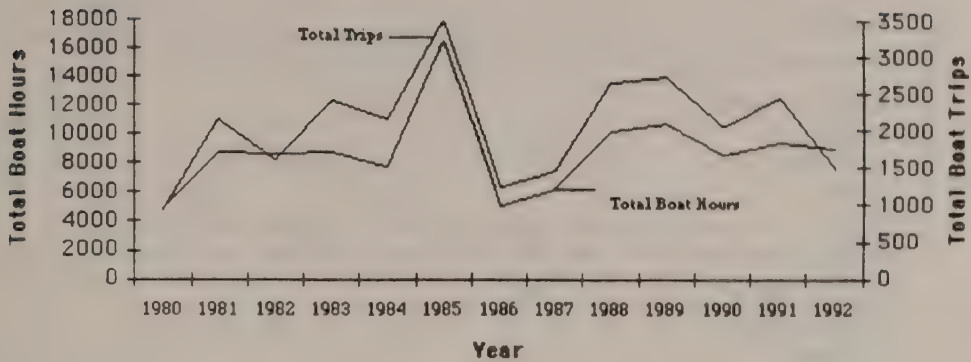
Data Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPACFIN originated commercial landings system.

Calculations: The creel survey data are the same as in the Figure G-1. The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings data base and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created based on as many factors as possible depending on the year, including: an analysis of the "disposition of catch" data available from the DAWR offshore creel survey; and evaluation of the fishermen in the fishery and their entry/exit patterns; general "dock side"

knowledge of the fishery and the status of marketing conditions and structure; the overall number of records in the data base; and a measure of the best educated guess.

Interpretations: The major fluctuations in the bottomfish fishery are believed to be fishery based, not stock based. This is due to the relatively small size of the bottomfishing fleet and frequent changes in the actual participants. Additionally, including surveys at Agat Marina will reduce the overall variance in the data significantly.

Guam Estimated Boat Hour and Boat Trips



Year	Total Boat Hours	Total Trips
------	------------------	-------------

1980	4,752	929
1981	8,804	2,150
1982	8,621	1,606
1983	8,699	2,401
1984	7,730	2,160
1985	16,477	3,471
1986	5,018	1,246
1987	6,264	1,447
1988	10,208	2,653
1989	10,818	2,732
1990	8,628	2,060
1991	9,440	2,444
1992	9,072	2,234

Figure G-3

Data Source: The DAWR creel survey data for bottomfishing.

Calculations: The estimated number of boat trips and boat hours for the bottomfishing method are derived directly from the creel survey expansion algorithms.

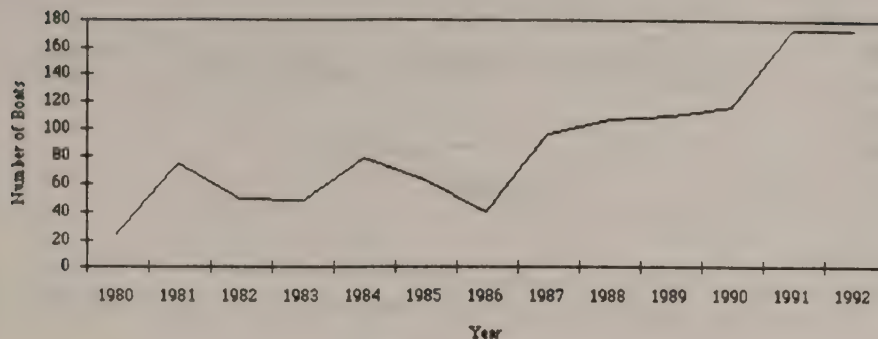
Interpretations: These two measures of effort nearly mirror each other and the previous figure for catch. The increase in effort for 1991 is attributed to the shift in participation to Agat Marina. This situation is justification for increasing the survey to incorporate the Agat Marina.

Table G-2. Guam 1992 commercial landed bottomfish average price.

Species	Avg. \$/lb
Bottomfish	2.84
Grouper	2.44
Jacks	2.19
Lehi	2.78
Uku	2.53
Ehu	3.28
Onaga	4.58
Opakapaka	3.21
Kalekale	3.17
Gindai	3.52
Emperor	2.78
All Bottomfish Species	2.81

Note: The source of this information is different than the values presented for harvest and therefore the species covered may vary slightly between data bases.

Guam Estimated Number of Boats Participating in the Bottomfish Fishery



Year	Number of Boats	Year	Number of Boats
1980	24	1986	39
1981	75	1987	96
1982	49	1988	107
1983	48	1989	110
1984	79	1990	116
1985	63	1991	173
		1992	173

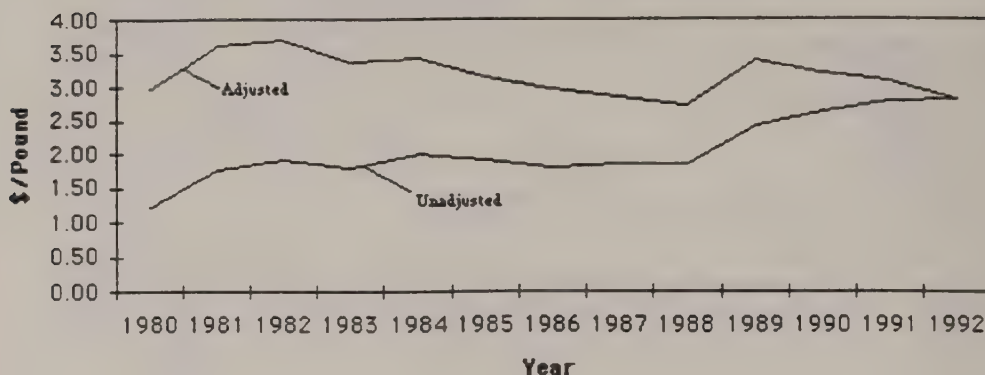
Figure G-4

Source: DAWR offshore creel survey data from Agana Boat Basin.

Calculations: The "threshold" C/E model was run a minimum of 15 times per year and the median estimated number of boats is presented above. These numbers should be considered as conservative estimates because boats which use unsurveyed launch sites will never be encountered and because surveys are conducted on only 13 % of the possible days.

Interpretations: Over the last several years the number of boats in this fishery has increased steadily, while the value for 1991 represents almost a 50% increase in participation. This increase can not be fully explained but is expected to be a reflection of the exceptionally calm weather and the healthy economy which has made it possible for more residents to afford boats.

Guam Average Price of Bottomfish (Adjusted for Inflation)



Year	\$/lb ¹	\$/lb ²	Year	\$/lb ¹	\$/lb ²
1980	1.22	2.98	1986	1.85	2.98
1981	1.78	3.60	1987	1.86	2.86
1982	1.93	3.71	1988	1.87	2.74
1983	1.81	3.36	1989	2.43	3.41
1984	2.00	3.42	1990	2.66	3.23
1985	1.91	3.15	1991	2.81	3.09
			1992	2.84	2.84

¹ Unadjusted

² Adjusted

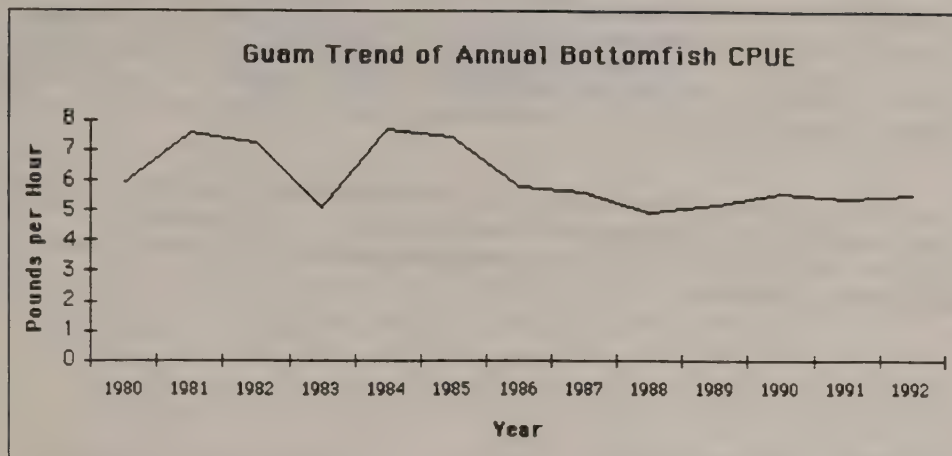
Figure G-5

Source: The commercial landings data from the major wholesaler.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1991 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1991 CPI by the CPI for any given year). Then you multiply the unadjusted average price by this factor to obtain the adjusted average price for the given year.

Interpretations: The adjusted average price for bottomfish has not shown consistent marketing trends. This is expected to have resulted from the seasonal supply of pelagic fish and difficulties in developing the marketing of locally caught fish. In addition, imported fish from other near-by areas has contributed to the continued marketing problem for local fishermen.

4.3 ANALYSIS OF INDICATORS



Year	CPUE (lbs/hour)	Year	CPUE (lbs/hour)
1980	5.9	1986	5.8
1981	7.6	1987	5.6
1982	7.3	1988	5.0
1983	5.1	1989	5.3
1984	7.7	1990	5.6
1985	7.5	1991	5.4
		1992	5.5

Figure G-6

Source: The DAWR creel survey data for bottomfishing.

Calculations: The catch-per-hour fishing for each trip surveyed is treated as a separate observation in calculating the average CPUE for the bottom fishing method. The sum of the individual trip CPUE's for surveyed trips is divided by the total number of surveyed trips.

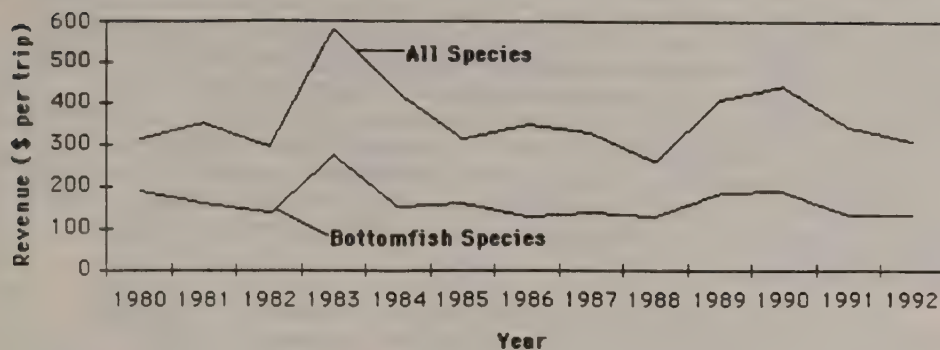
Interpretations: The annual CPUE fluctuates between 5 and 8 pounds per hour, but has been fairly stable for the past 7 years. No problems are indicated by CPUE.

Mean Fish Size:

Although data was collected in 1992 on mean length for eleven important bottomfish species, from the DAWR Creel sampling program, it could not be analyzed due to the loss of the data processor. (Please refer to Figures G-7 through G-17 of the 1991 bottomfish annual report for size information analyzed through 1991.)

Available data (1980-1991) do not show any indication of declining mean size for any of the species. Subjective observation of the 1992 fishery suggests that no significant changes have occurred.

Guam Average Revenue per Trip



Year	\$/Trip All Species	\$/Trip Bottomfish
1980	189	189
1981	161	161
1982	137	137
1983	273	273
1984	149	149
1985	159	159
1986	284	125
1987	269	136
1988	215	128
1989	314	186
1990	364	187
1991	308	132
1992	308	134

Fig G-7

Data Source: Commercial landings data from the Guam Fisherman's Coop, the major wholesaler.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip which landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Interpretations: The adjusted average revenue per trip does not appear to show any single long term trend.

4.4 SUMMARY

An important consideration in reviewing the 1992 data for Guam's fishery is the change in the methods utilized in expanding the data. Due to losses of staff the normal expansion algorithms could not be used. The information presented was expanded by physical input into spreadsheets. Although the estimates are considered to be of equivalent accuracy, the accompanied statistics of confidence and partitioning of assorted catches by species were not possible. Due to the physical processing of annual data as opposed to the normal computer expansion, the mean length of fish for BMUS species could not be completed. Once additional staff have been acquired the 1992 data will be keypunched and reanalyzed.

The analysis of the Guam bottomfish fishery does not show any problems through review of Fishery Management Plan descriptors or indicators. This is suspected to be the result of the continued use of small vessels which are limited by weather and moderate levels of effort into the fishery. The data collected and indicators analyzed for Guam's bottomfish fishery again show no need for management action.

As a result of the significant losses of staff, no progress was made in the 1991 Annual Bottomfish Report recommendation to conduct a study on the red-gilled emperor.

4.5 RECOMMENDATIONS

The 1992 data is not representative of the data analysis required for the bottomfish report. This resulted from the loss of the data processor. Until this position has been refilled the data processing and report generation will not meet the standards established for both the Western Pacific Regional Fisheries Management Council nor the WESPACFIN Cooperative Agreement. This deficiency jeopardizes both the integrity of the data and the funding of these programs. An effort to ratify this deficiency should be pursued quickly and the analysis of the available data repeated with the computerized expansion.

The need to complete a baseline biological survey for the red-gilled emperor still remains the single most important data deficiency for the Northern Marianas bottomfish resource and therefore the previous recommendation to establish a joint program with the CNMI remains a high priority. Sufficient data from these less exploited areas should facilitate calculation of SPRs.

5.0 REPORT FROM HAWAII

5.1 INTRODUCTION

This module is comprised of information from three programs within the Honolulu Laboratory, National Marine Fisheries Service (NMFS). Kurt Kawamoto and Sam Pooley of the Fishery Monitoring & Economics Program (FMEP) provided information on the Northwestern Hawaiian Islands (NWHI) fishery from information collected by the NMFS shoreside monitoring program. Pooley also provided information on overall market revenue (NWHI, main Hawaiian Islands [MHI], and imports) and price trends based on the same data sources. Summaries of Hawaii Division of Aquatic Resources (HDAR) commercial marine landings statistics for the period 1970-92 were prepared by FMEP computer programming staff. Don Kobayashi, of the Insular Stock Assessment Program, and Robert Moffitt, of the Fisheries Systems Dynamics Program, provided most of the MHI and NWHI fishery indicators such as mean weight in the catch, percent immature in the catch, catch-per-unit of fishing effort (CPUE), and spawning potential ratio (SPR), using NMFS and HDAR data. Bob Humphreys of the Insular Ecology Study provided material on the seamount groundfish (armorhead) CPUE and SPR based on NOAA vessel Townsend Cromwell research cruises and foreign fishery statistics.

This year's report includes two new analyses for the MHI: statistical tests for consistency in species catch composition over time and between areas; and CPUE trends over time for major targeted species.

5.2 DISCUSSION OF DESCRIPTORS

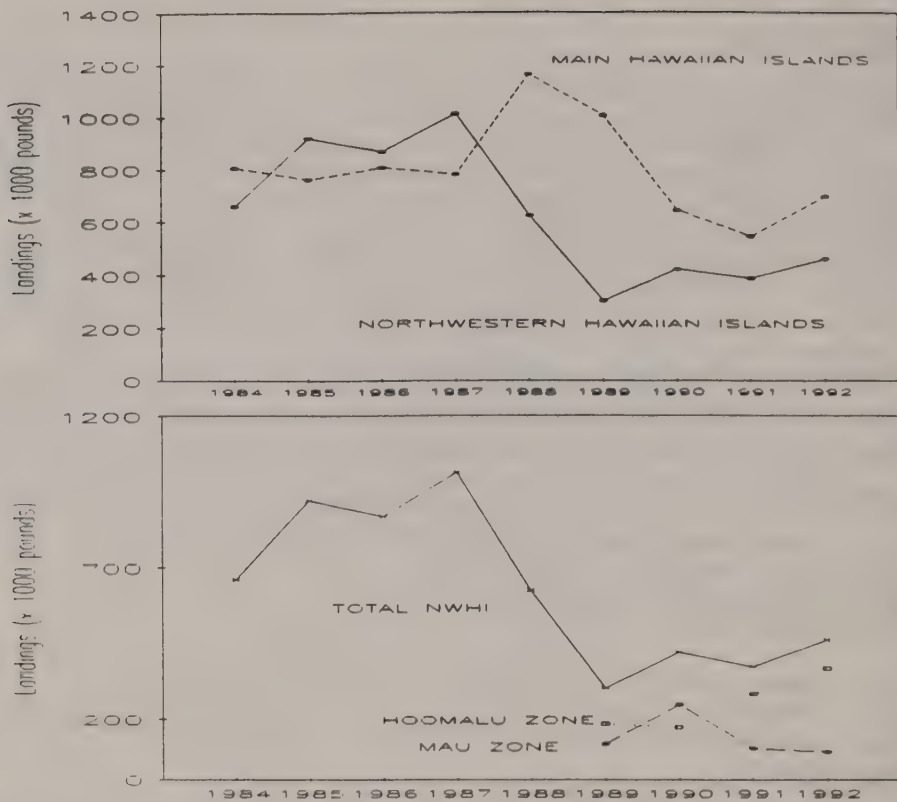


FIGURE H-1. Hawaii's bottomfish landings for the NWHI and MHI, 1984-1992; and Mau and Hoomalu zones of the NWHI, 1989-1992.

Hawaii's bottomfish landings NWHI and MHI, 1984-1992 (thousands of pounds).

Area	1984	1985	1986	1987	1988	1989	1990	1991 ¹	1992 ¹
Mau	NA	NA	NA	NA	NA	118	249	103	71
Hoomalu	NA	NA	NA	NA	NA	184	173	283	353
TOTAL	661	922	869	1015	625	303	421	387	424
MHI ²		807	764	810	784	1164	1006	646	548
698 ³									

¹ NWHI data from combination NMFS and HDAR.

² Data from HDAR.

³ Preliminary estimate.

Data source: NWHI landings data for 1984-1990 collected by Honolulu Laboratory's market monitoring program. The 1991 and 1992 NWHI landings are a combination of NMFS and HDAR data. MHI landings are from HDAR data.

Calculations & adjustments: National Marine Fisheries Service data are presented as an expanded estimate to approximate the total market volume. Market expansion factors are based on a 1979 survey of wholesale markets in Hawaii and on recent landing patterns of specific fleets.

The 1992 data set is a combination of the NMFS and the HDAR data which has been extrapolated to account for missing trips.

MHI landings are unadjusted for (unknown) recreational landings.

Comments: The landings in the NWHI showed an overall increase in 1992. Both zones experienced a decrease in the number of trips. The resultant catch showed an increase in the Hoomalu zone and a decrease in the Mau zone.

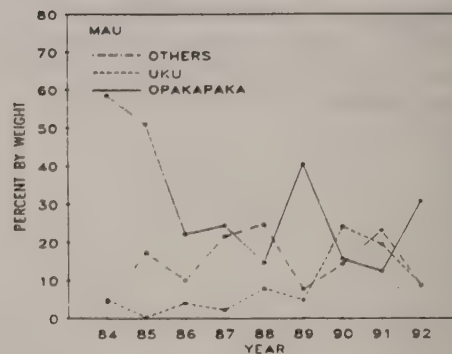
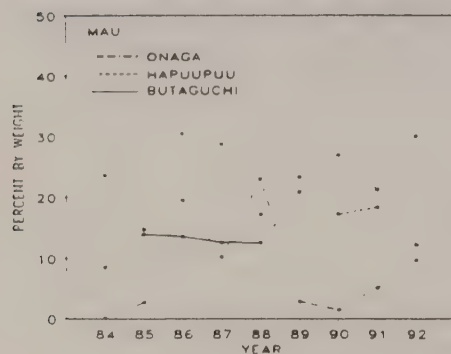
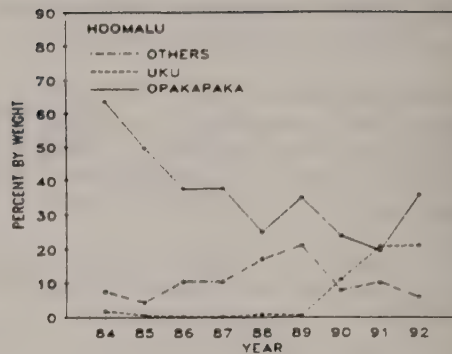
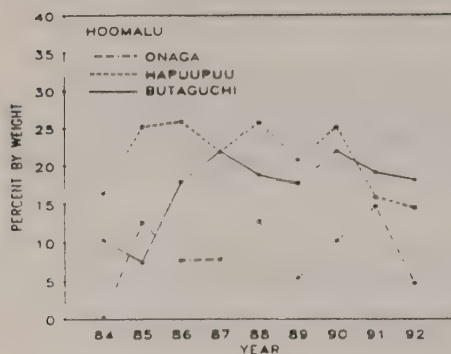


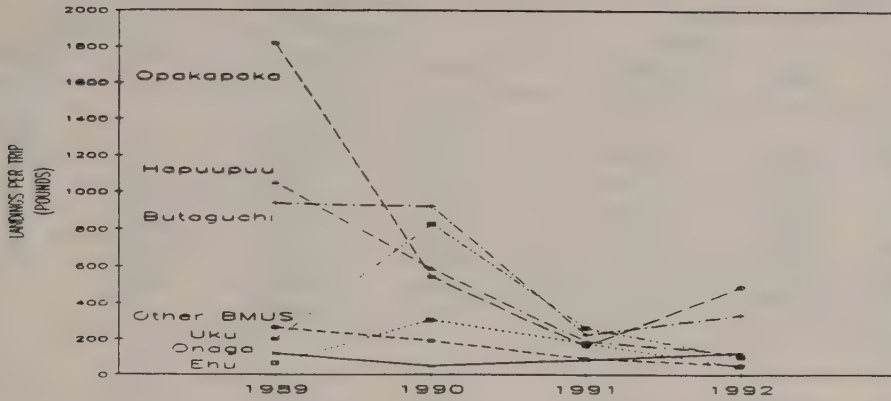
FIGURE H-2. NWHI bottomfish catch composition.

Data source: Catch data collected at the Honolulu auction by the NMFS market monitoring program and vessel interview program.

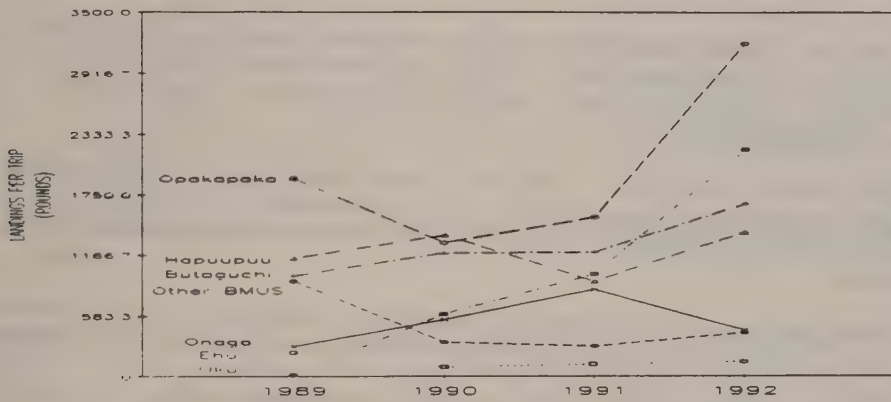
Calculations & adjustments: Catch composition is expressed as percent of total bottomfish weight.

Interpretation: Butaguchi, onaga, and opakapaka increased in the 1992 Mau zone catch composition, while other species decreased. Opakapaka increased in the 1992 Hoomalu zone catch composition, while onaga decreased. The remaining species in the Hoomalu zone remained stable or changed only slightly in 1992.

Variation between years and between areas may be due to differential targeting or availability of fish.



MAU Zone Landings per Trip, 1989-1992.



HOOMALU Zone Landings per Trip, 1989-1992.

FIGURE H-3. NWHI BMUS composition of landings by weight, Mau and Hoomalu zones 1989-1992.

TABLE H-1. NWHI BMUS landings composition by trip, 1990¹, 1991², 1992².

Species	1990		1991		1992	
	Mau	Hoomalu	Mau	Hoomalu	Mau	Hoomalu
Opakapaka	541	1284	163	1530	448	3208
Onaga	49	550	83	837	124	450
Ehu	309	94	176	113	48	148
Hapuupuu	590	1357	189	913	121	1386
Butaguchi	923	1185	228	1196	336	1660
Uku	830	600	266	985	100	2187
Other BMUS	193	333	94	297	56	425
Total per trip	3435	5403	1200	5873	1273	9464

¹ Data from NMFS monitoring.

² Data from combination of NMFS and HDAR data sets.

Data source: Landings data collected by Honolulu Laboratory's market monitoring program. Data for 1990 are from NMFS monitoring. Data for 1991 and 1992 are from a combination of NMFS and HDAR data.

Comments: The Mau zone landings have remained nearly static with fluctuating species landings. The opakapaka and butaguchi landings have increased while the ehu and uku landings have decreased.

Landings for the Hoomalu zone has showed a large increase. The onaga landings were the only BMUS that showed a decrease.

Variation between years and between areas may be due to differential targeting or availability of fish.

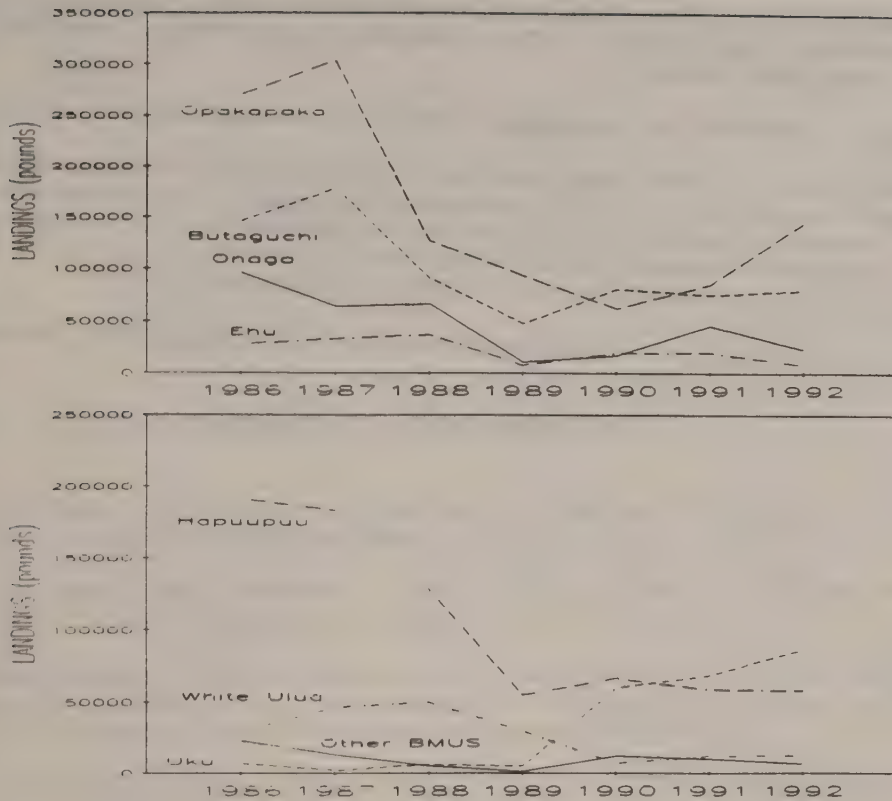


FIGURE H-4 NWHI BMUS composition of landings by weight, 1986-1992.

NWHI BMUS composition of landings by weight¹, 1986-1992.

Species	1986	1987	1988	1989	1990	1991 ²	1992 ²
Opakapaka	270	304	127	94	62	86	145
Onaga	96	64	66	11	16	46	23
Ehu	28	33	37	8	19	20	8
Hapuupuu	191	183	128	55	66	59	57
Butaguchi	146	178	91	48	80	75	79
Uku	7	2	6	5	60	69	86
White ulua	29	46	50	30	7	12	12
Other BMUS	23	13	5	1	12	10	6

¹ Landings = x 1000 pounds.

² Data from a combination of NMFS and HDAR data.

Data source: Landings data collected by Honolulu Laboratory's market monitoring program. The 1992 data are from a combination of NMFS and HDAR data.

Comments: Landings of opakapaka and uku have shown an increase.

The trend in the landings over the years have shown that fishermen target on the most abundant or easily caught species of value. When the catch rate of a targeted species declines or another species becomes more economically feasible to catch or more abundant, a switching of target species occurs.

Variation between years may be due to differential targeting or availability of fish.

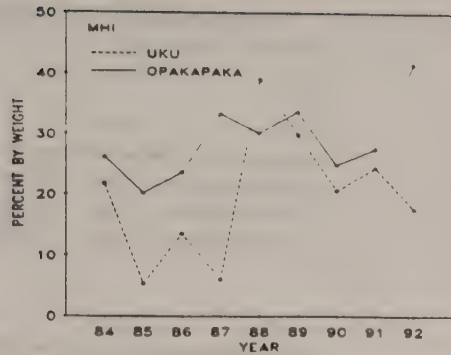
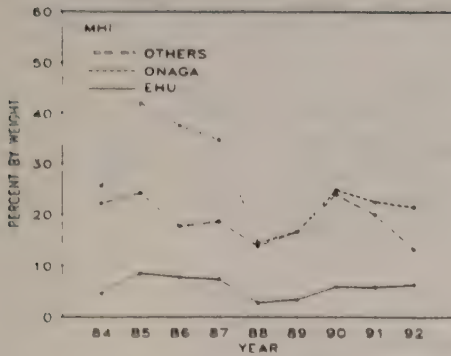


FIGURE H-5. MHI bottomfish catch composition.

Data source: Catch data collected at the Honolulu auction by the NMFS market monitoring program.

Calculations & adjustments: Catch composition is expressed as percent of total bottomfish weight.

Interpretation: The percentage of opakapaka in the MHI catch has increased in 1992. Ehu has remained relatively stable, while onaga, uku, and other BMUS species have declined.

Variation between years may be due to differential targeting or availability of fish.

Statistical analyses: Kendall's tau, Spearman's rho, and Kendall's W (overall concordance) tests were applied to the ranked data to test for consistency in the catch composition 1) over time, and 2) between areas, for the data presented in Figures H-5 and H-2 (Table H-2). Yearly blocks of species' rankings for each area were used in 1), and areal blocks of yearly rankings for each species were used in 2). To minimize the number of comparisons in 1), 3 year averages were used. The following tables show the results of the tests; significance is designated at $p < 0.05$ by an asterisk following the K, S, or KW. Significance in the K and S tests indicate correlation between the pairs of ranks; significance in the KW test indicate concordance over all the ranks examined. The species referred to as ULT is pooled ulua, lehi, and taape. Species composition is consistent over time, but there is little correlation between areas.

TABLE H-2. Consistency in catch composition over time and between areas.

MHI	KW*		
1984-1986	vs. 1987-1989	K*	S*
1987-1989	vs. 1990-1992	K*	S*
1984-1986	vs. 1990-1992	K*	S*

MAU	KW*		
1984-1986	: 1987-1989	K*	S*
1987-1989	: 1990-1992	K*	S*
1984-1986	: 1990-1992	K	S*

HOOMALU	KW*		
1984-1986	: 1987-1989	K*	S*
1987-1989	: 1990-1992	K*	S*
1984-1986	: 1990-1992	K*	S*

	MHI : MAU			MAU : HOO			MHI : HOO		
OPA	K	S		K*	S*		K	S	KW
ONA	K	S		K	S		K	S	KW
HAP	K	S		K	S		K	S*-	KW
BUT	K	S*		K	S		K	S*	KW*
EHU	K	S		K	S*		K	S	KW
KAL	K	S		K	S		K	S*	KW
GIN	K	S		K	S		K	S	KW
UKU	K	S		K*	S*		K	S	KW*
ULT	K*	S*		K	S		K	S	KW

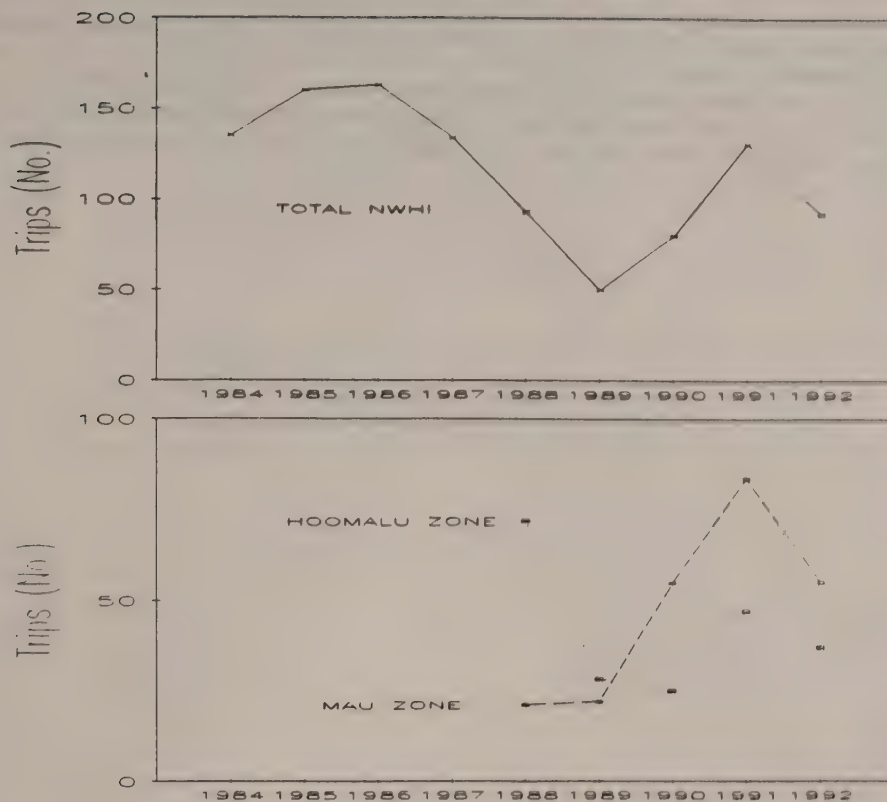


FIGURE H-6. Number of trips made by the NWHI bottomfish fleet 1984-1992, Mau and Hoomalu zones 1988-1992.

NWHI bottomfish fleet vessel trip activity 1984-1992.

Area	1984	1985	1986	1987	1988	1989	1990	1991 ¹	1992 ¹
Mau	NA	NA	NA	NA	21	22	55	84	55
Hoomalu	NA	NA	NA	NA	72	28	25	47	37
Total	135	160	163	134	93	50	80	131	92

¹ Based on combined NMFS and HDAR data.

Data source: Trip data collected by Honolulu Laboratory's market monitoring program. The 1992 data are the result of a combination of NMFS and HDAR data sets.

Comments: The limited entry program started in 1989. The 1990 number of Mau zone entrants increased due to the limited access into the Hoomalu zone. In 1991 the Mau zone showed a trip count increase due to the combined data set used. The hurricane "Iniki" that passes over Kauai in September 1992 has severely restricted current activities of the Kauai based fishing fleet.

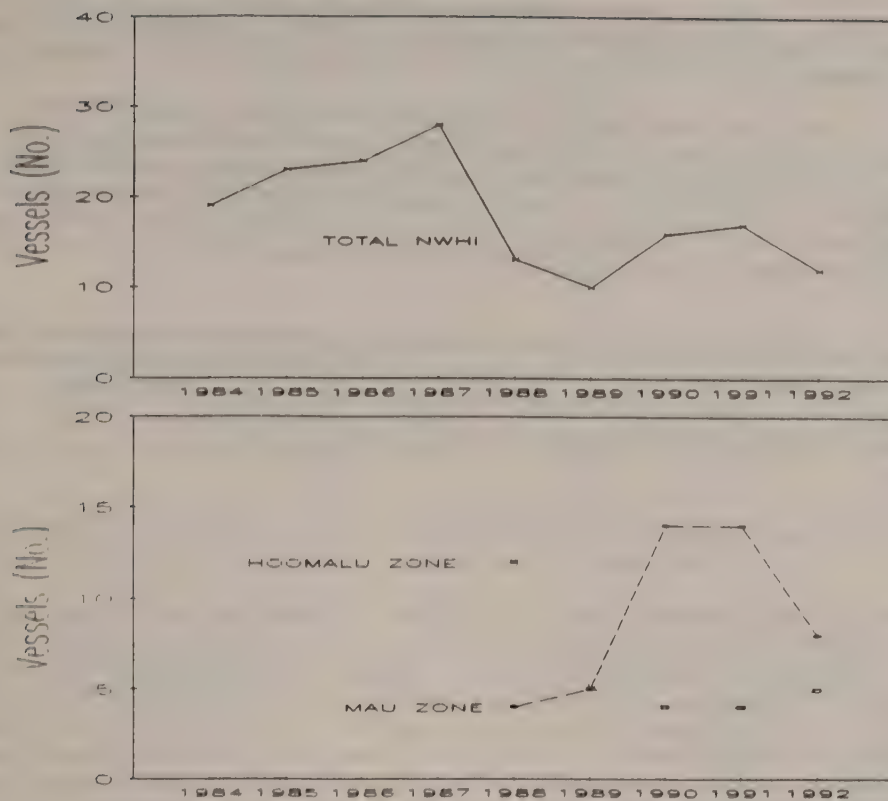


FIGURE H-7. Number of vessels in the NWHI bottomfish fleet 1985-1992, Mau and Hoomalu zone 1988-1992.

NWHI bottomfish fleet vessel activity 1985-1992.

Area	1985	1986	1987	1988	1989	1990	1991 ¹	1992 ¹
Mau	NA	NA	NA	4	5	14	14	8
Hoomalu	NA	NA	NA	12	5	4	4	5
Total ²	23	24	28	13	10	16	17	13

¹ Based on a combination NMFS and HDAR data set.

² Total may not match sum of areas due to vessel participation in multiple areas.

Data source: Vessel participation data collected by Honolulu Laboratory's market monitoring program. The 1991 and 1992 data are the result of a combination of NMFS and HDAR data sets.

Comments: The limited entry program started in 1989 thereby decreasing the number of participants into the Hoomalu zone fishery. The 1990 increase in the Mau zone vessel participation is a result of the limited entry plan forcing all new entrants into the Mau zone. Presently, the lower level of activity in the Mau zone reflects the inactivity of the Kauai based fleet in 1992.

The 1992 number of active vessels are based on a combination of NMFS and HDAR data and represents three additional vessels that would have otherwise been missed using only NMFS data. These additional vessels are Mau zone participants.

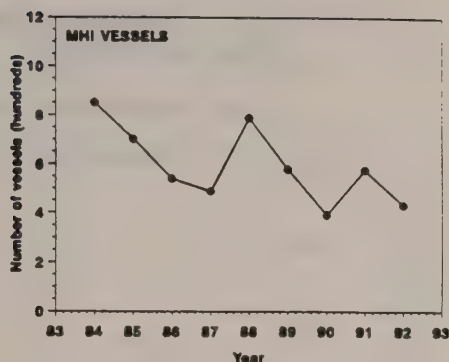
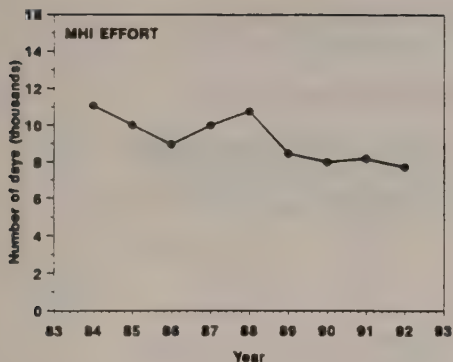


FIGURE H-8. Bottomfishing trips and vessels in the MHI.

Data source: Fishing effort and vessels estimates are based on HDAR catch report data from commercial fishermen.

Calculations & adjustments: MHI trips and vessels estimated from annual total adjusted MHI bottomfish landings, mean CPUE, and mean total landings per vessel. These estimates represent standardized bottomfishing trips and vessels, using the same criteria as the MHI CPUE calculations described in H-14. All values have changed from previous year's reports due to reliance on HDAR data rather than Honolulu auction data. The landings estimate is adjusted with a preliminary expansion factor for recreational landings, estimated from early results of the 1990-1991 HDAR contracted small-boat fisheries survey (Hamm & Lum 1992).

Interpretation: MHI effort and participation in the bottomfish fishery continue on a decreasing trend.

Tabulated values:

YEAR	MHI	
	TRIPS	VESSELS
1984	11069	852
1985	10015	703
1986	8933	541
1987	10010	487
1988	10761	789
1989	8465	580
1990	8011	390
1991	8214	579
1992	7748	432

Hawaii Bottomfish Revenue 1984 to present

NMFS estimates & records and HDAR records

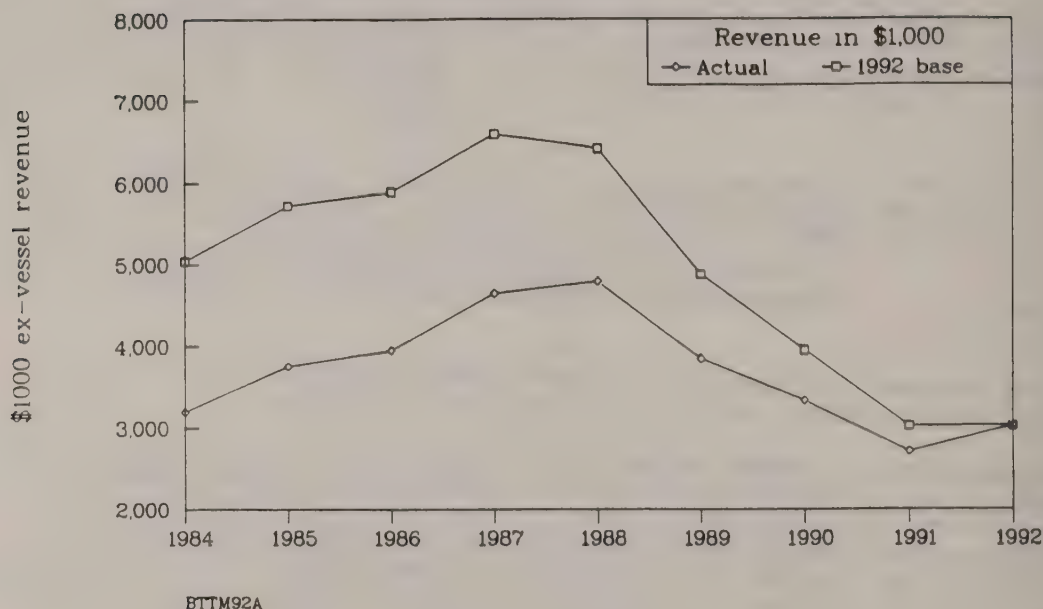


FIGURE H-9. Hawaii bottomfish domestic landings revenue, 1984-1992. NMFS estimates. Nominal (actual) and inflation-adjusted (1992 base year) revenue.

Data source: Data are collected by NMFS shoreside monitoring for the NWHI and compiled from HDAR commercial catch reports for the MHI. See H-10 for tabulated values.

Calculations & adjustments: NWHI estimates for 1984-1990 are compiled solely from NMFS shoreside monitoring. NWHI estimates for 1991 and 1992 compiled by combining NMFS shoreside monitoring figures with HDAR commercial catch reports. MHI revenue for 1992 is preliminary. Prices are at the ex-vessel level.

Revenue is adjusted for inflation by multiplying each year's nominal (actual) revenue by the ratio of the 1992 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues to the same purchasing power basis as 1992 revenue.

Interpretation: The time-series shows a dramatic decline in the late 1980s, with a slight up-turn in 1992. Both NWHI and MHI landings have declined over the period.

Hawaii Bottomfish Revenue 1984 to present

NMFS Estimates

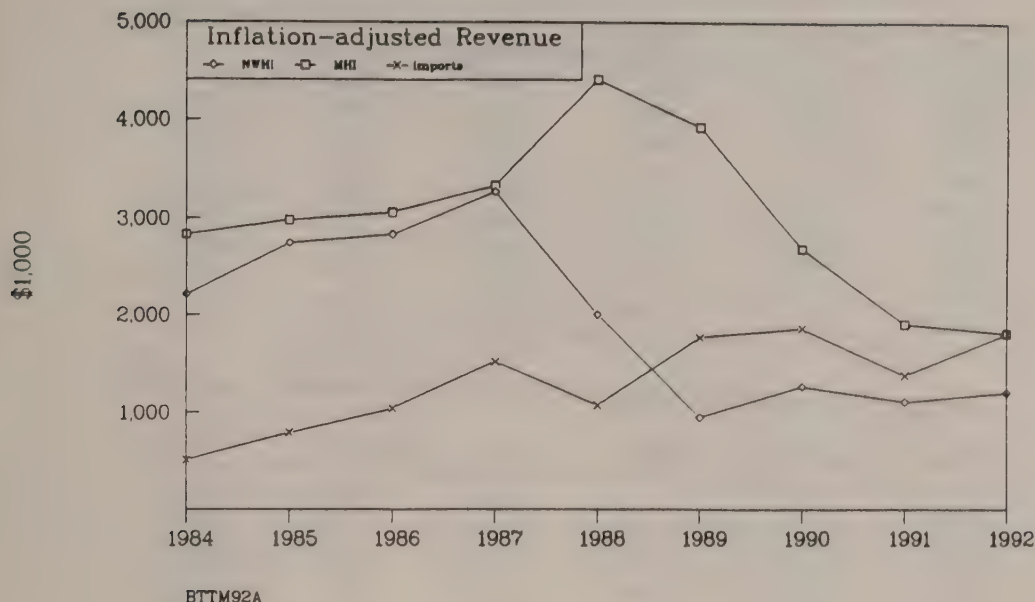


FIGURE H-10. Hawaii's bottomfish market, 1984-1992.

Data source: NWHI revenue data are collected by the NMFS Honolulu Laboratory's shoreside monitoring program. MHI revenue is compiled from HDAR commercial catch reports. Import revenue data are compiled by the NMFS Southwest Region's Market News program from U.S. Food & Drug Administration monitoring of shipments into the Honolulu Customs District.

Calculations & adjustments: Revenue is adjusted for inflation to 1992 price levels by the Honolulu consumer price index (CPI). Import revenue is calculated from shipment volumes using NWHI average prices. MHI data for 1992 are preliminary.

Interpretation: Overall bottomfish market dollar volume (adjusted for inflation) has fallen with the overall decline in the domestic bottomfish fishery. However there has been a slowly growing influx of imported bottomfish into the Honolulu market.

Tabulated values:

Hawaii Bottomfish (1984 to present)

NMFS estimates & records and HDAR records

Year	Hawaii	NWHI	MHI	Imports	Total
1984	1,464	661	803	152	1,616
1985	1,687	922	765	264	1,951
1986	1,680	869	811	319	1,999
1987	1,799	1,015	784	472	2,271
1988	1,791	626	1,165	334	2,125
1989	1,310	303	1,007	564	1,874
1990	1,082	421	661	620	1,702
1991	948	387	561	479	1,427
1992	1,012	424	588	634	1,646

Hawaii Bottomfish Revenue (\$1,000 ex-vessel revenue)

Year	Hawaii	NWHI	MHI	Imports	Total
1984	3,196	1,400	1796	322	3,518
1985	3,754	1,800	1954	515	4,269
1986	3,951	1,900	2,051	697	4,648
1987	4,644	2,300	2,344	1,070	5,714
1988	4,788	1,500	3,288	800	5,588
1989	3,840	750	3,090	1,396	5,236
1990	3,335	1,070	2,265	1,576	4,911
1991	2,711	1,000	1,711	1,238	3,949
1992	3,026	1,210	1,816	1,809	4,835

Inflation-adjusted revenue (\$1,000)

Year	Hawaii	NWHI	MHI	Imports	Total	HCPI
1984	5,044	2,209	2,834	508	5,552	104.30
1985	5,727	2,746	2,981	786	6,513	107.90
1986	5,896	2,835	3,061	1,041	6,937	110.30
1987	6,595	3,266	3,329	1,519	8,114	115.90
1988	6,418	2,011	4,407	1,073	7,491	122.80
1989	4,873	952	3,921	1,772	6,645	129.70
1990	3,952	1,268	2,684	1,867	5,819	138.90
1991	3,021	1,114	1,907	1,379	4,401	147.70
1992	3,026	1,210	1,816	1,809	4,835	164.60

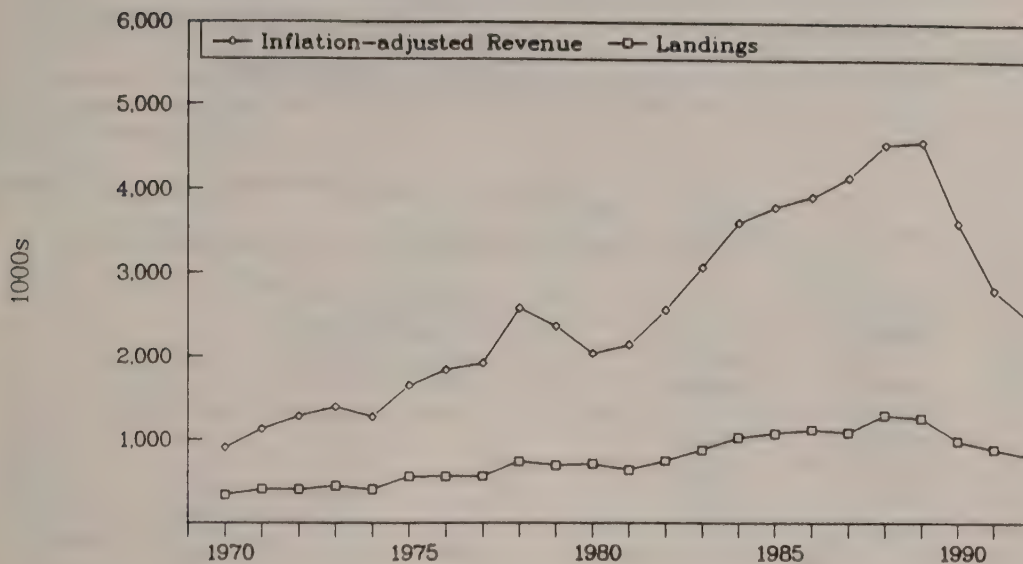
NWHI from NMFS samples (expanded)

MHI from HDAR (GAS program)

MHI 1992 are preliminary

Hawaii bottomfish fishery
1970-1992

Hawaii Division of Aquatic Resources data

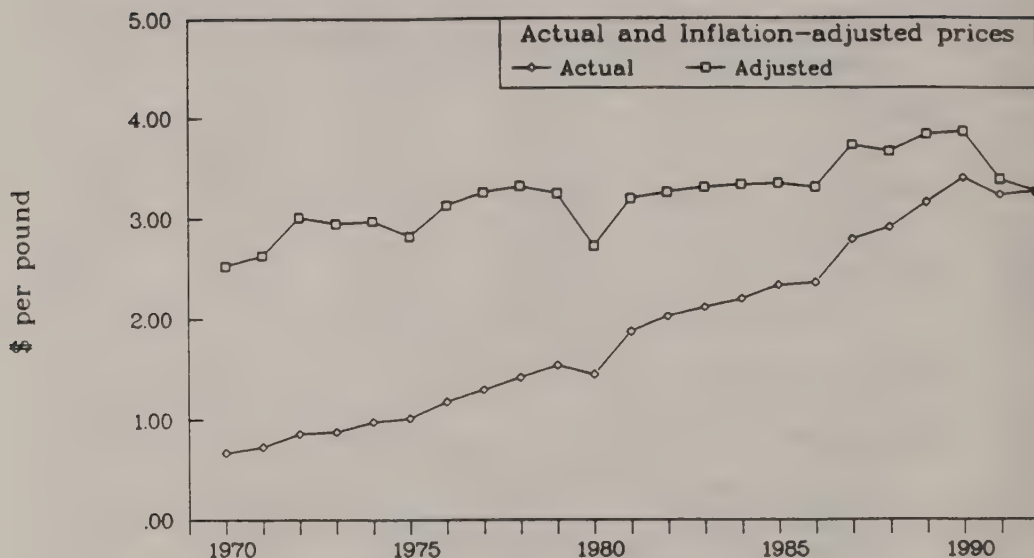


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FIGURE H-11. Hawaii bottomfish landings, revenue, and average price, 1970-1992. Hawaii Division of Aquatic Resources (HDAR) commercial catch reports compiled by NMFS. Revenue and price adjusted to 1992 base year.

Hawaii bottomfish fishery 1970-1992

Hawaii Division of Aquatic Resources data



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FIGURE H-11a. Hawaii bottomfish landings, revenue, and average price, 1970-1992.

Data source: Data are from the HDAR commercial catch reports data tapes, compiled by NMFS with the GAS (HDAR Gear-Area-Species summary compilation) computer programs.

Calculations & adjustments: HDAR landings for 1992 are preliminary. The available data were adjusted upwards by approximately 12% to account for incomplete reporting (based on the ratio of license holders).

Revenue represents ex-vessel revenue. Price is overall average price for all bottomfish species combined.

Inflation-adjusted revenue and prices are constructed by multiplying each year's nominal (actual) revenue or average price by the ratio of the 1992 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues and prices to the same purchasing power basis as 1992 revenue and average price.

Interpretation: These figures would differ from a series which would combine NMFS estimates of NWHI landings with HDAR commercial catch reports, for the MHI during the 1984-1992 time period, because of apparent under-reporting of NWHI landings to the State. Nonetheless, these figures show the combined effect of growth in domestic bottomfish landings from the mid-1970s through the mid-1980s, along with an increase in inflation-adjusted average price. The latter represents strong marketing of the bottomfish product, which also probably encouraged continued fishing pressure. However average prices have declined in 1991 and 1992.

Tabulated values:

HDAR data Hawaii bottomfish fishery 1970-1992

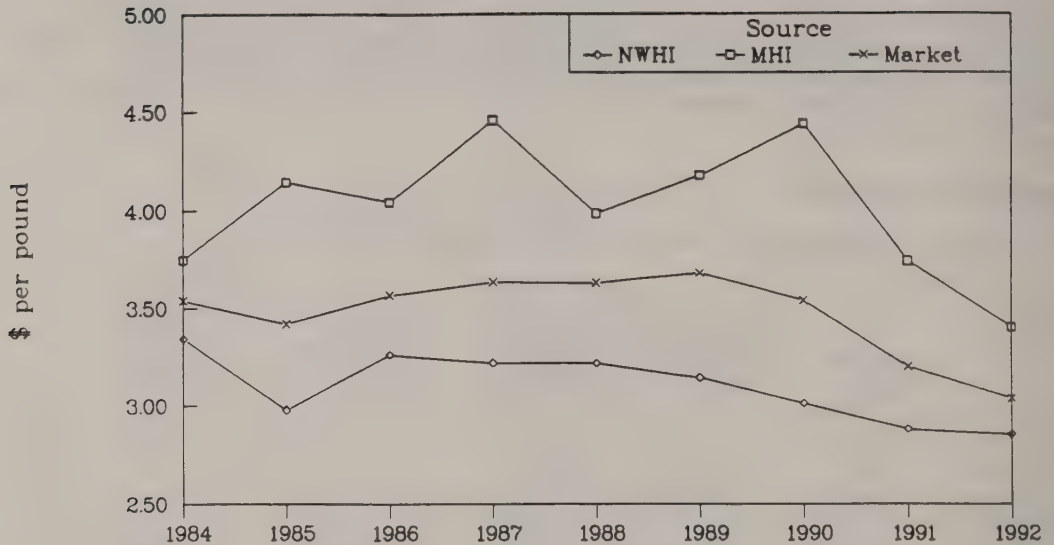
	Landings 1000s	Nominal Revenue \$1000	Inflation- adjusted Revenue \$1000	Actual Price \$/pound	Inflation Adjusted Price \$/pound	HCPI
1970	344	243	919	.73	2.74	114.20
1971	410	312	1,134	.78	2.84	118.90
1972	407	366	1,288	.93	3.28	122.80
1973	454	418	1,407	.95	3.21	128.30
1974	413	421	1,282	1.06	3.24	141.90
1975	550	584	1,628	1.16	3.24	155.00
1976	558	693	1,839	1.33	3.52	162.80
1977	562	764	1,921	1.43	3.60	171.80
1978	740	1,101	2,584	1.56	3.66	184.10
1979	698	1,123	2,372	1.69	3.58	204.50
1980	713	1,082	2,044	1.62	3.06	228.70
1981	643	1,262	2,157	2.07	3.54	252.80
1982	752	1,601	2,580	2.23	3.60	268.10
1983	890	1,977	3,096	2.31	3.61	275.90
1984	1,046	2,398	3,637	2.40	3.64	284.80
1985	1,091	2,698	3,867	2.58	3.70	301.40
1986	1,136	2,820	3,953	2.61	3.66	308.20
1987	1,128	3,134	4,181	2.88	3.84	323.80
1988	1,299	3,600	4,533	2.90	3.65	343.05
1989	1,262	3,765	4,570	3.15	3.83	355.90
1990	992	3,174	3,605	3.39	3.85	380.35
1991	887	2,673	2,799	3.22	3.38	412.50
1992	798	2,436	2,436	3.26	3.26	432.00

1992 data are preliminary

Data compiled by NMFS using the GAS (Gear-Area-Species) summary computer program on HDAR data tapes

Hawaii bottomfish prices 1984-present

NMFS estimates & records and HDAR records



BTTM92A

FIGURE H-12. Hawaii bottomfish average market price by source, 1984-1992. NMFS estimates, inflation-adjusted to 1992 base.

Data source: Data are from NMFS monitoring of NWHI landings and HDAR commercial catch reports for NWHI and MHI landings. Import volume (pounds) is recorded by the NMFS Southwest Region Market News office.

Calculations & adjustments: HDAR figures for 1992 are preliminary. Data from the MHI and NWHI sources and from imports were combined by NMFS into the market category. NWHI average prices are used to estimate import market dollar volume.

Inflation-adjusted revenue and prices are constructed by multiplying each year's nominal (actual) revenue or average price by the ratio of the 1992 Honolulu consumer price index (CPI) to each year's CPI. This adjusts early year revenues and prices to the same purchasing power basis as 1992 revenue and average price.

Interpretation: Overall average prices for MHI landings are generally greater than NWHI landings. Inflation-adjusted prices have declined in both 1991 and 1992 from all sources, although a number of important individual species nominal (not adjusted for inflation) prices increased in 1992.

Tabulated values:

Hawaii Bottomfish Average nominal prices

Year	Hawaii	NWHI	MHI	Imports	Total
1984	2.26	2.12	2.38	2.12	2.24
1985	2.29	1.95	2.72	1.95	2.24
1986	2.43	2.19	2.71	2.19	2.39
1987	2.64	2.27	3.14	2.27	2.56
1988	2.76	2.40	2.97	2.40	2.70
1989	3.09	2.48	3.29	2.48	2.90
1990	3.25	2.54	3.74	2.54	2.98
1991	3.02	2.58	3.35	2.58	2.87
1992	3.16	2.85	3.40	2.85	3.04

Inflation-adjusted average prices by source

Year	Hawaii	NWHI	MHI	Imports	Total
1984	3.56	3.34	3.75	3.34	3.54
1985	3.49	2.98	4.15	2.98	3.42
1986	3.63	3.26	4.04	3.26	3.57
1987	3.74	3.22	4.46	3.22	3.63
1988	3.70	3.21	3.98	3.21	3.62
1989	3.92	3.14	4.18	3.14	3.68
1990	3.85	3.01	4.44	3.01	3.54
1991	3.37	2.88	3.74	2.88	3.20
1992	3.16	2.85	3.40	2.85	3.04

Hawaii bottomfish market prices NMFS & HDAR figures

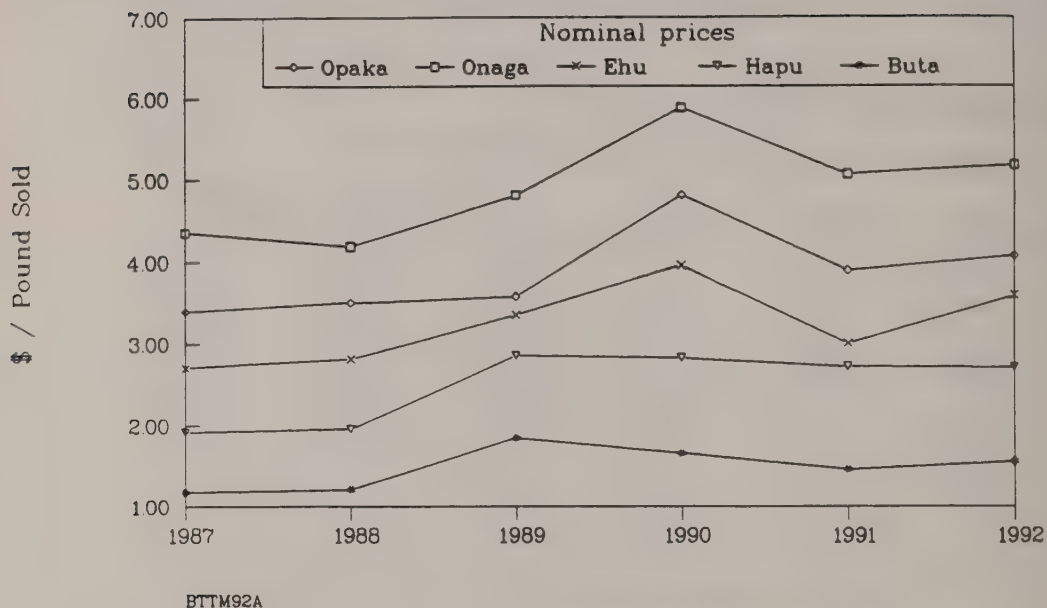


FIGURE H-13. Hawaii bottomfish prices by species and source, 1987-1992.

Data source: MHI data are from HDAR commercial catch reports. NWHI data are from NMFS shoreside monitoring. Import revenue data are compiled by the NMFS Southwest Region's Market News program from U.S. Food & Drug Administration monitoring of shipments into the Honolulu Customs District.

Calculations & adjustments: Average price data are calculated by NMFS by combining MHI and NWHI estimates of landings and revenue. Import prices are NWHI overall average prices. Inflation-adjustment is of the overall market price which is calculated as a weighted average of MHI, NWHI, and imports.

Interpretation: Prices for the most important bottomfish species remained stable or rose in 1992 on a nominal basis, compared to 1991, but overall market prices failed to recover completely on an inflation-adjusted basis due to changes in species composition.

Tabulated values:

Hawaii bottomfish market prices 1984 to present (including imports)

	1987	1988	1989	1990	1991	1992
Opaka	3.40	3.51	3.58	4.81	3.89	4.06
Onaga	4.36	4.19	4.81	5.88	5.06	5.17
Ehu	2.71	2.82	3.36	3.96	3.00	3.58
Hapu	1.92	1.96	2.86	2.83	2.72	2.71
Buta	1.18	1.21	1.85	1.66	1.46	1.56
Other	1.84	1.96	2.42	2.61	2.56	2.31
Imports	2.33	2.37	2.97	2.04	2.11	2.86
Total	2.75	2.71	3.08	3.11	2.80	3.08
Inflation adjusted	3.91	3.63	3.91	3.69	3.12	3.08
HCPI	115.90	122.80	129.70	138.90	147.70	164.60

Northwestern Hawaiian Islands

	NWHI 1987	NWHI 1988	NWHI 1989	NWHI 1990	NWHI 1991	NWHI 1992
Opaka	3.27	3.54	3.78	4.19	3.53	3.98
Onaga	3.23	3.30	3.23	3.82	4.47	3.87
Ehu	2.36	2.01	1.85	2.65	2.71	2.51
Hapu	1.87	1.84	2.61	2.65	2.50	2.57
Buta	1.16	1.05	1.31	1.39	1.19	1.51
Other	1.56	2.23	1.20	2.57	2.68	2.51
Total	2.33	2.37	2.61	2.65	2.68	2.86
Inflation adjusted	3.31	3.18	3.31	3.14	2.99	2.86

(continued)

Main Hawaiian Islands

	MHI 1987	MHI 1988	MHI 1989	MHI 1990	MHI 1991	MHI 1992
Opaka	3.64	3.55	3.51	5.07	3.97	4.14
Onaga	4.81	5.06	4.92	6.10	5.22	5.56
Ehu	3.52	3.80	3.71	4.73	3.84	3.92
Hapu	2.51	2.99	3.64	3.44	3.02	3.30
Buta	2.17	2.54	3.16	3.38	1.92	3.34
Other	2.12	1.91	2.52	2.62	1.87	2.23
Total	3.58	2.90	3.26	4.09	3.35	3.40
Inflation adjusted	5.08	3.89	4.14	4.85	3.73	3.40

5.3 ANALYSIS OF INDICATORS

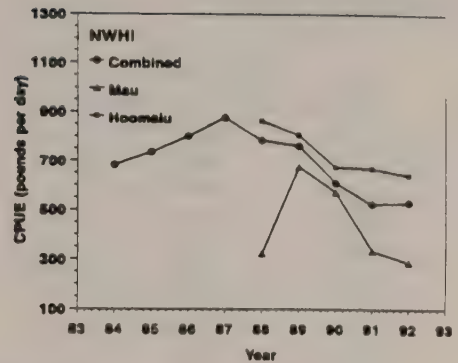
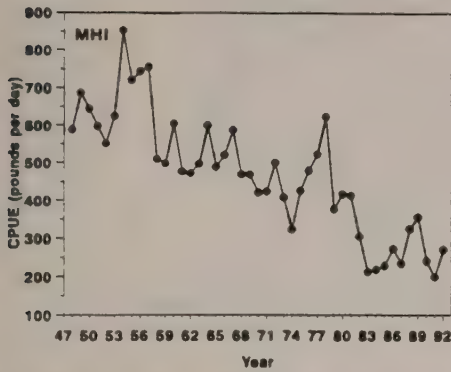


FIGURE H-14. CPUE for Hawaiian bottomfish.

Data source: MHI CPUE is based on HDAR catch report data from commercial fishermen. NWHI CPUE is based on Honolulu auction data and vessel interview data collected by the NMFS market monitoring program.

Calculations & adjustments: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on maximum annual landings criteria to correct for temporal changes in the fleet composition. Previous reports utilized fiscal year averages for the MHI CPUE because license numbers are renewed on the fiscal year and screening is done at the individual license level. Starting this year, the screened data are regrouped by calendar year prior to averaging. The 1992 calendar year data point only includes January-June catch report data. The NWHI CPUE has changed slightly to now match the NMFS FMEP published estimates. Data prior to 1988 do not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well.

Interpretation: There is a long-term decreasing trend in MHI CPUE, with current values approximately half that of initial, signifying a yellow light condition. However, no such decrease is apparent over the past decade. The increase in the late 1980's MHI CPUE was due primarily to the large increase in uku catches. The 1992 MHI CPUE has increased slightly from the 1991 value. NWHI CPUE is still on a decreasing trend in both Mau and Hoomalu zones.

Results might differ slightly had samples been proportionally weighted from all main Hawaiian islands, rather than the current bias toward catch from the Penguin Bank, Maui/Molokai/Lanai bottom fishing ground.

Tabulated values:

YEAR	MHI CPUE (LBS PER DAY)
1948	589
1949	687
1950	644
1951	597
1952	551
1953	625
1954	853
1955	721
1956	744
1957	757
1958	510
1959	498
1960	604
1961	477
1962	472
1963	497
1964	600
1965	488
1966	520
1967	587
1968	469
1969	469
1970	421
1971	424
1972	501
1973	409
1974	323
1975	426
1976	480
1977	523
1978	623
1979	377
1980	417
1981	413
1982	305
1983	212
1984	219
1985	229
1986	272
1987	235
1988	325
1989	357
1990	242
1991	200
1992	270

NWHI CPUE (LBS PER DAY)			
YEAR	MAU	HOOMALU	COMBINED
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	287	643	531

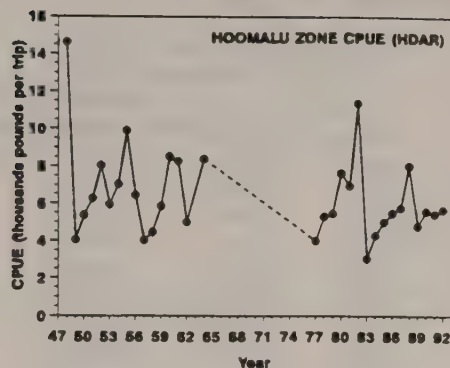
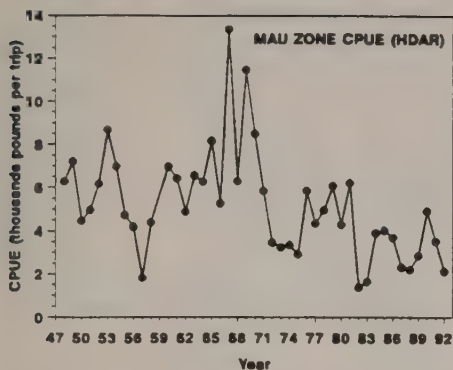


FIGURE H-14a. HDAR CPUE for NWHI bottomfish.

Data source: The HDAR CPUE for the NWHI uses HDAR catch report data from commercial fishermen instead of the NMFS auction data and vessel interview data, as used in the previous figure for NWHI CPUE.

Calculations & adjustments: Trips were screened to include only those where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish was caught. All catch data reported by the same licensee on consecutive days was collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather than fishing activity. There was an apparent absence of Hoomalu zone trips from the mid-1960's until the late-1970's.

Interpretation: The HDAR CPUE data set is not directly comparable to the NMFS CPUE set in that it is expressed in pounds/trip, not pounds/day. Correction factors needed to compare these two data sets are not available due to lack of data on possible changes in trip duration and fleet composition. The Mau zone HDAR CPUE has been decreasing since 1990, which is consistent with the NMFS CPUE trend. The Hoomalu zone HDAR CPUE, however, has been increasing since 1989, which is in contrast to the NMFS CPUE trend. The difference between the two data trends for the Hoomalu zone can be explained by the incompatibility of the two data sets as described above. The HDAR CPUE data set is used instead of the more sensitive NMFS CPUE set in calculations of NWHI SPR, since it is a longer time series (1947-present v. 1984-present) and better estimates virgin v. current fishery catch rates.

Tabulated values:

CPUE (LBŞ PER TRIP)		
YEAR	MAU	HOOMALU
1948	6273	14635
1949	7199	4048
1950	4455	5366
1951	4950	6246
1952	6158	8026
1953	8684	5935
1954	6969	7023
1955	4709	9916
1956	4156	6424
1957	1805	4024
1958	4373	4480
1959	NA	5856
1960	6962	8527
1961	6399	8275
1962	4859	5006
1963	6529	NA
1964	6240	8390
1965	8151	NA
1966	5229	NA
1967	13352	NA
1968	6267	NA
1969	11484	NA
1970	8499	NA
1971	5819	NA
1972	3447	NA
1973	3220	NA
1974	3333	NA
1975	2894	NA
1976	5820	NA
1977	4315	4000
1978	4938	5300
1979	6067	5464
1980	4271	7637
1981	6210	6944
1982	1336	11370
1983	1612	3025
1984	3890	4286
1985	4011	5007
1986	3688	5473
1987	2305	5772
1988	2191	8036
1989	2854	4802
1990	4921	5615
1991	3522	5451
1992	2110	5689

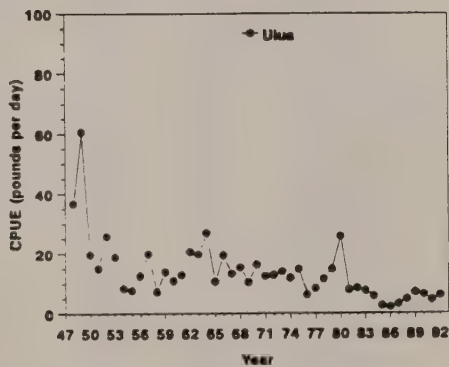
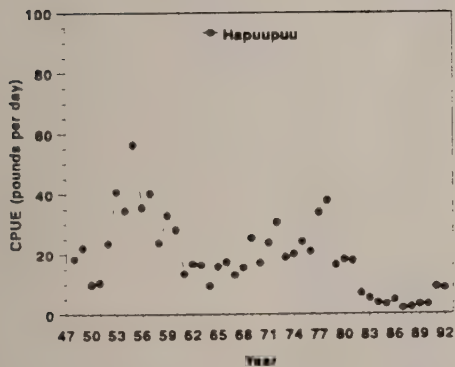
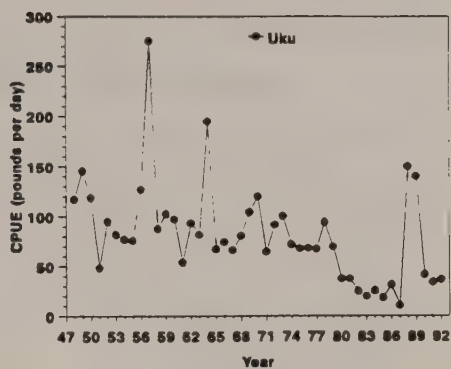
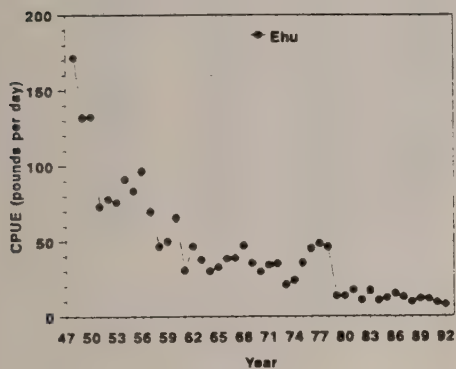
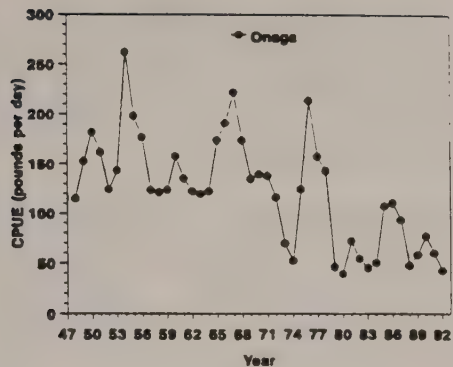
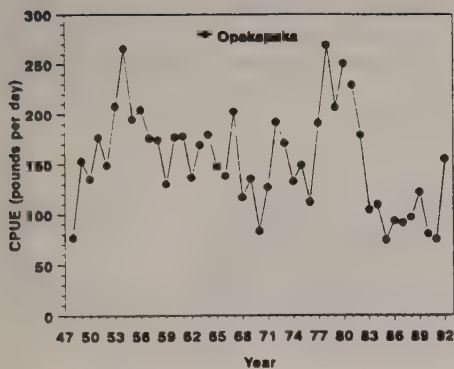


FIGURE H-14b. Partial CPUE for MHI bottomfish.

Data source: The partial CPUE for the MHI uses HDAR catch report data from commercial fishermen.

Calculations & adjustments: The same subset of HDAR data as used in H-14 is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in H-14 is used here (# days fished), i.e., summing these six partial CPUE's (and remaining BMUS CPUE's) will approximate the H-14 estimates.

Interpretation: All CPUE time series remain highly variable which may be, at least in part, due to unknown changes in species targeting and may not adequately reflect actual changes in species abundance. There are, however, apparent declines in CPUE for most species when comparing several years of recent values with early years. The decline is least apparent in opakapaka and most apparent in ehū.

Tabulated values:

PARTIAL CPUE (POUNDS PER DAY)						
YEAR	OPA	ONA	EHU	UKU	HAP	ULU
1948	76	114	171	117	18	36
1949	153	152	131	145	22	60
1950	135	181	132	118	9	19
1951	176	161	73	48	10	15
1952	148	124	78	95	23	25
1953	207	143	75	82	40	18
1954	265	262	91	77	34	8
1955	194	198	83	75	56	7
1956	204	176	96	126	35	12
1957	176	123	70	275	40	19
1958	174	121	46	87	23	7
1959	130	123	50	102	32	13
1960	176	158	65	97	28	10
1961	178	135	30	53	13	12
1962	136	122	46	93	16	20
1963	169	119	37	81	16	19
1964	179	122	29	195	9	26
1965	147	173	32	67	15	10
1966	137	191	38	74	17	19
1967	202	221	38	66	13	13
1968	116	173	47	80	15	15
1969	135	134	35	104	25	10
1970	82	139	29	120	17	16
1971	126	138	34	64	23	12
1972	192	116	35	91	30	12
1973	171	69	21	100	18	13
1974	132	52	24	72	19	11
1975	148	124	35	67	24	14
1976	111	213	45	68	20	6
1977	190	157	48	67	33	8
1978	269	143	46	94	37	11

(continuation)

PARTIAL CPUE (POUNDS PER DAY)

YEAR	OPA	ONA	EHU	UKU	HAP	ULU
1979	206	46	13	69	16	14
1980	250	39	13	37	18	25
1981	229	72	17	37	17	7
1982	179	54	10	24	6	8
1983	104	45	17	19	5	7
1984	109	50	10	25	3	5
1985	73	107	12	18	3	2
1986	93	110	15	31	4	2
1987	91	93	12	10	1	3
1988	96	47	9	150	2	4
1989	122	58	11	140	3	7
1990	80	77	11	41	3	6
1991	74	60	9	33	9	4
1992	155	43	7	36	8	6

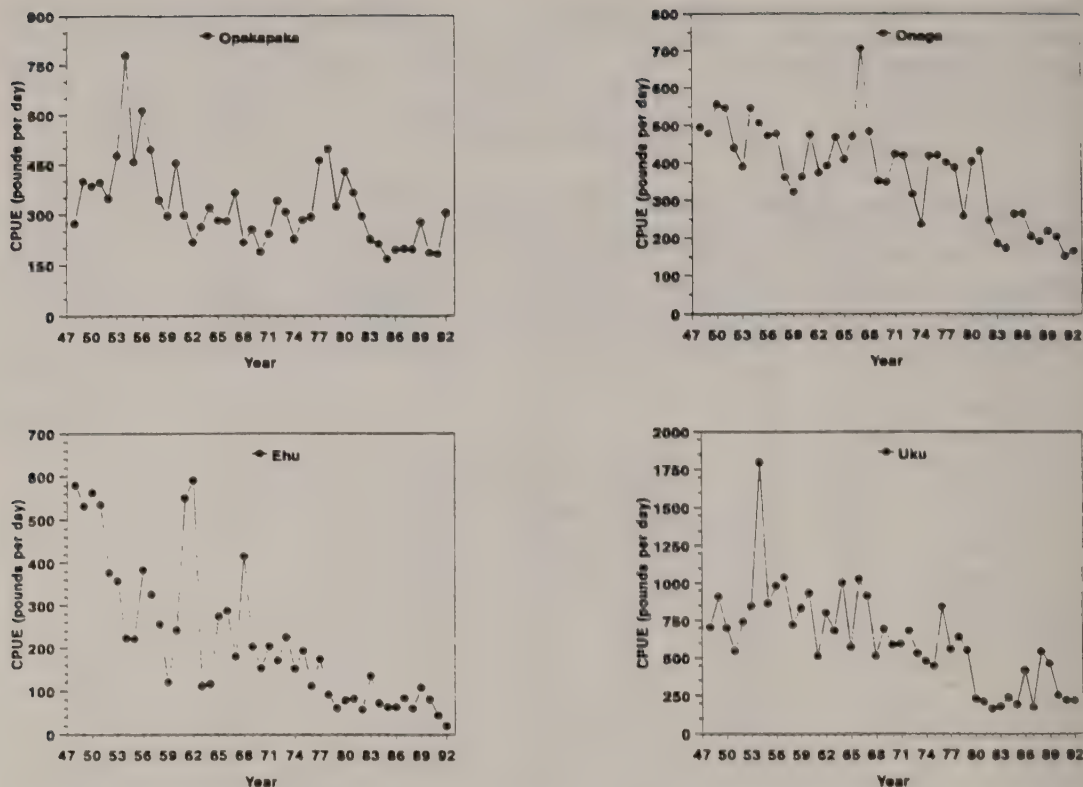


FIGURE H-14c. Partial targeted CPUE for MHI bottomfish.

Data source: The partial CPUE for the MHI uses HDAR catch report data from commercial fishermen.

Calculations & adjustments: The data used in H-14 were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch.

Interpretation: The CPUE values presented here should be better representations of species abundance than those in H-14b because they are based solely on trips targeting specific species. The degree of screening, however, severely reduces the size of the sample which may contribute to some of the remaining variability. As in H-14b, there are apparent declines when comparing several recent years with early years. The decline is least apparent in opakapaka (about 50% reduction) and most apparent in ehu (nearly 90% reduction). The magnitude of these declines (>50%) indicate a yellow light condition for ehu, onaga, uku and (possibly) opakapaka.

Tabulated values:

YEAR	CPUE (POUNDS PER DAY)			
	OPA	ONA	EHU	UKU
1948	273	495	580	704
1949	400	479	531	913
1950	385	556	563	701
1951	396	547	535	548
1952	348	440	378	744
1953	476	390	358	849
1954	779	547	224	1796
1955	458	507	222	868
1956	613	473	384	987
1957	496	478	327	1042
1958	342	362	257	722
1959	294	323	121	836
1960	454	363	242	939
1961	296	475	550	513
1962	216	374	591	805
1963	261	393	111	683
1964	319	469	116	1006
1965	280	410	275	574
1966	278	471	288	1030
1967	364	706	179	919
1968	214	484	415	515
1969	254	352	203	695
1970	187	349	153	588
1971	240	424	204	594
1972	339	419	170	683
1973	306	317	225	531
1974	224	236	152	479
1975	282	418	193	448
1976	291	420	111	845
1977	462	402	174	558
1978	497	388	92	640
1979	322	258	60	551
1980	429	404	78	231
1981	364	432	83	212
1982	293	247	57	164
1983	225	186	135	179
1984	211	172	72	240
1985	167	264	63	193
1986	194	266	63	417
1987	197	205	84	174
1988	196	192	60	544
1989	276	220	108	464
1990	185	204	81	256
1991	182	152	44	221
1992	304	166	20	219

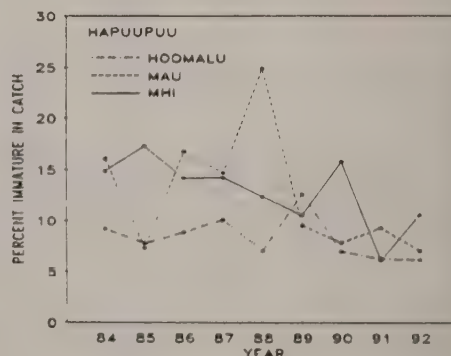
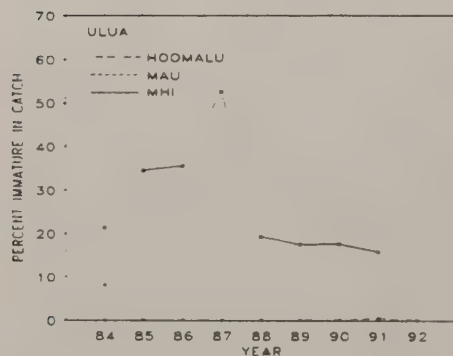
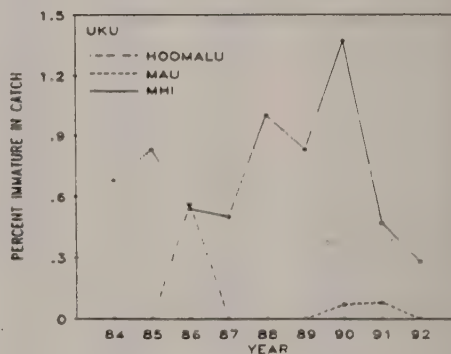
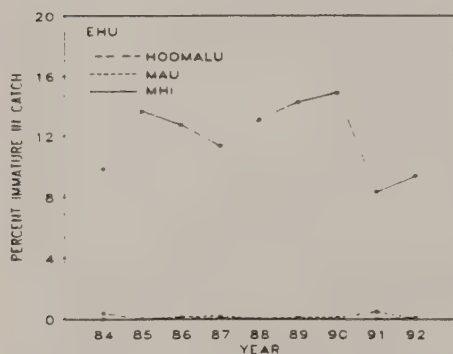
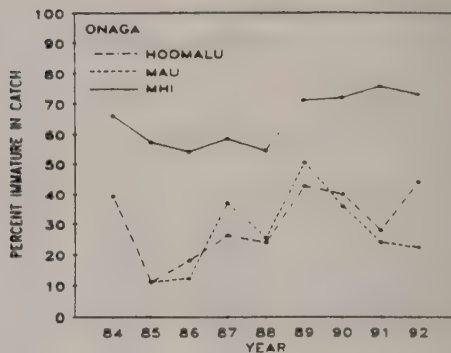
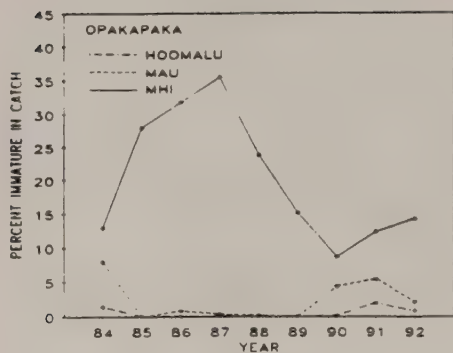


FIGURE H-15. Percent immature in Hawaiian bottomfish catch.

Data source: Catch data obtained from Honolulu auction by NMFS personnel. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

CALCULATION AND ADJUSTMENTS: Maturity was assumed to be "knife-edge", and all fish in the same lot were assumed to be of equal size. The percent immature is calculated in terms of weight.

INTERPRETATION: MHI catch is comprised of more immature fish than NWHI catch. MHI onaga catch has the highest percentage of immature fish, and is the only species consistently over fifty percent, signifying a yellow light condition. Percent immature for uku are the lowest (i.e., healthiest) values in all zones. Among the other species, opakapaka and ulua have experienced periods of relatively high percentage of immature fish in the MHI catch. These species displayed peaks in the years 1985-87 and have dropped considerably since. In all areas onaga has the highest values and these appear to be following a gradual increasing trend. The only other species which appears to be following a consistent long term trend is hapuupuu for which the percent immature appears to be dropping for all areas.

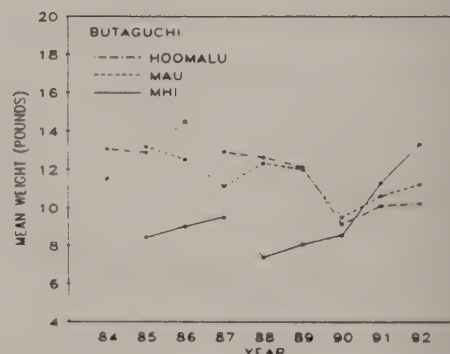
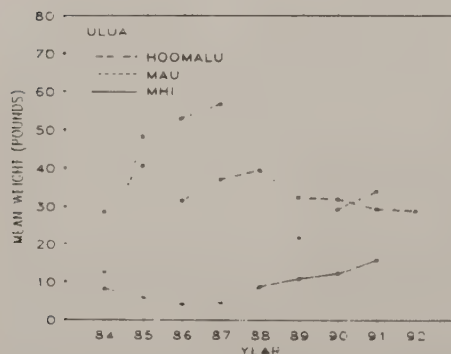
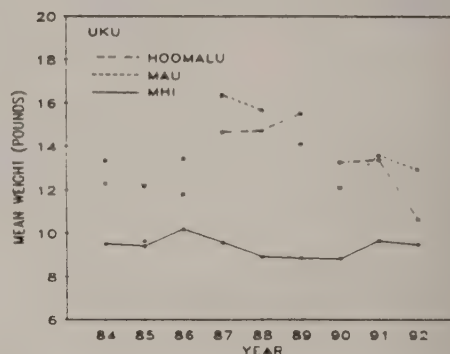
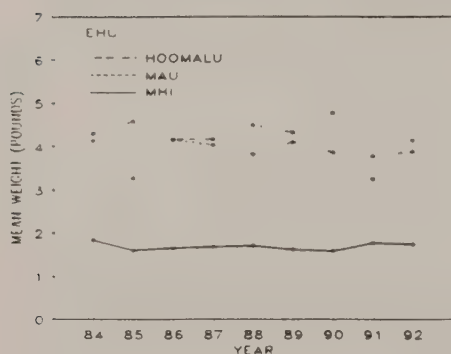
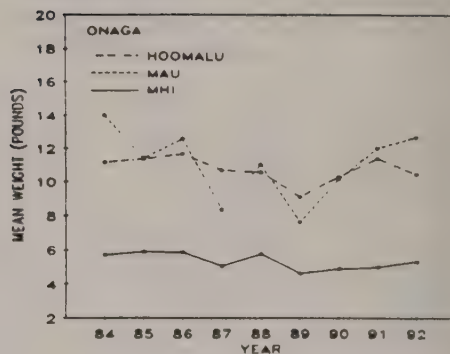
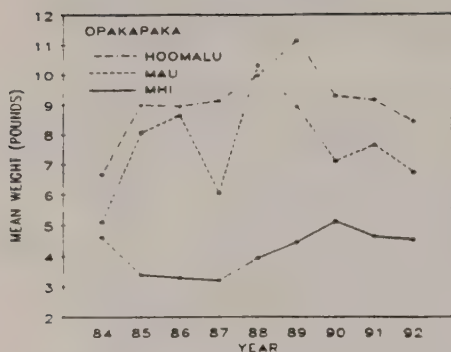


FIGURE H-16. Mean weight of Hawaiian bottomfish.

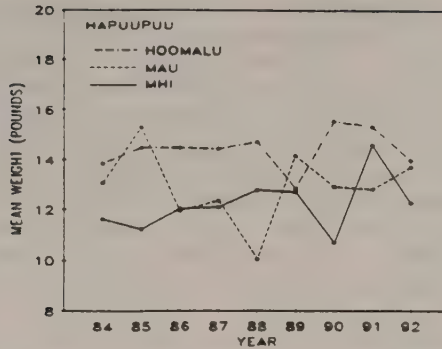


FIGURE H-16 (continuation). Mean weight of Hawaiian bottomfish.

Data source: Fish weight is obtained from catch data collected at the Honolulu auction by NMFS personnel.

Interpretation: Mean weights of fish in the NWHI catch are generally larger than those in the MHI catch. The 1992 values are basically similar to past values, with no indication of continuously decreasing size for any species or area. This may be indicative of the fishery approaching an equilibrium condition. Values for ulua and butaguchi in the MHI, however, have been increasing over time with the MHI butaguchi value surpassing the NWHI values for this species in 1991 and 1992.

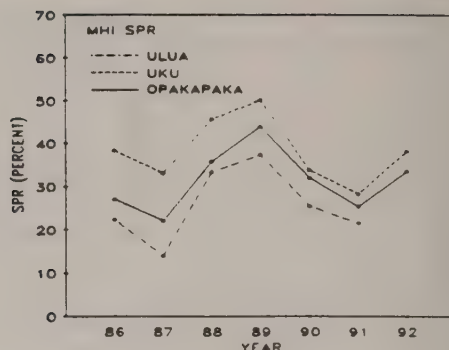
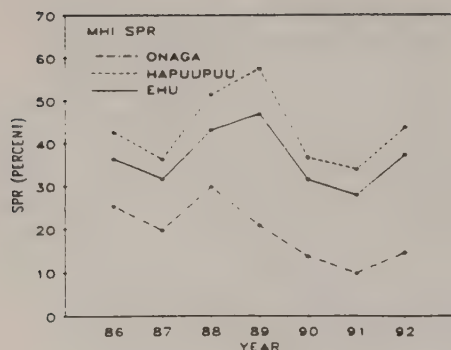


FIGURE H-17. Spawning Potential Ratio (SPR) for MHI bottomfish.

Data source: SPR estimated from Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R.V. Townsend Cromwell.

Calculation & adjustments: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is the 1948-1952 mean; current CPUE estimate is a single year estimate (versus three year averaging used in previous reports). Single year versus multiple year averaging was discussed at the March, 1993 Bottomfish Plan Team meeting. Single year estimates were favored since this is consistent with the format used for other biological indicators presented in time series format (e.g., CPUE, percent immature, and mean weight). CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Figure H-14 for details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. All SPR values changed slightly from previous year's reports due to calendar year grouping of HDAR data in the CPUE estimates and lack of multiple year averaging for the current CPUE estimates and catch size compositions.

Interpretation: The more timely availability of HDAR data and the calendar year (versus fiscal year) grouping of the CPUE data allowed two additional data points this year, although the 1992 point reflects only a half year of HDAR CPUE data. Previously, the first half calendar year of HDAR data was grouped with the second half calendar year of the previous year, due to the need to track HDAR licenses issued on the fiscal year. Additional programming steps were implemented this year allowing the raw catch data to be re-aggregated into calendar year data subsets after screening prior to calculating average CPUE.

Current SPR estimates for five of the six species are above the twenty percent critical level used as an indicator of recruitment overfishing. Onaga, however, has dropped below twenty percent for 1990 and 1991, and calendar 1992 (January-June HDAR CPUE data). The drop in the 1990 onaga SPR from 21 to 14 is due to the lack of multiple year averaging (1990 calendar year onaga SPR using multiple year averaging is 22, primarily due to the influence of the higher 1988-89 CPUE values and the lower pre-1990 percent immature values), and not a consequence of the calendar year versus fiscal year change in CPUE. Hapuupuu and uku SPR values remain consistently the highest.

The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings.

A recent investigation (Kobayashi, 1993b) suggests that white ulua SPR's are much higher than those estimated here due to the nature of the white ulua fishery and the assumptions of this SPR estimator with regard to size-selective patterns of fishing gear selectivity and stock vulnerability.

Tabulated values:

YEAR	SPR (%)					
	EHU	HAPU	ONAG	OPAK	UKU	ULUA
1986	36	43	25	27	38	22
1987	32	36	20	22	33	14
1988	43	51	30	36	46	33
1989	47	58	21	44	50	37
1990	32	37	14	32	34	25
1991	28	34	10	25	28	21
1992	37	44	15	33	38	NA

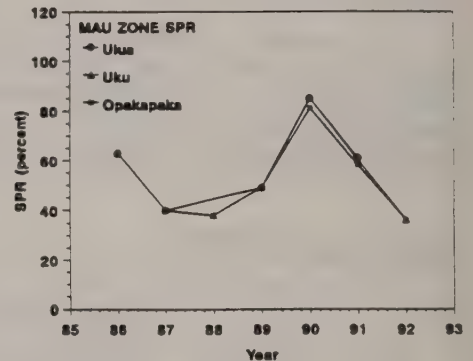
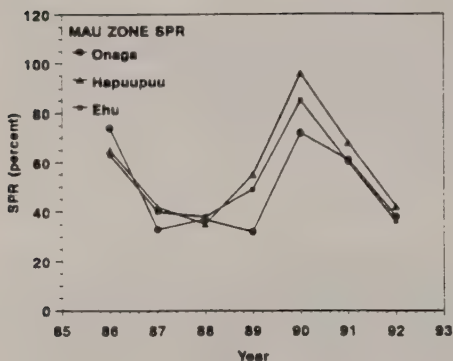
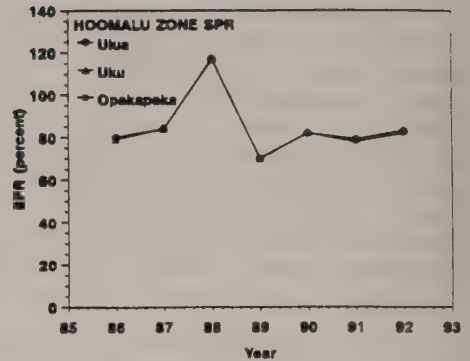
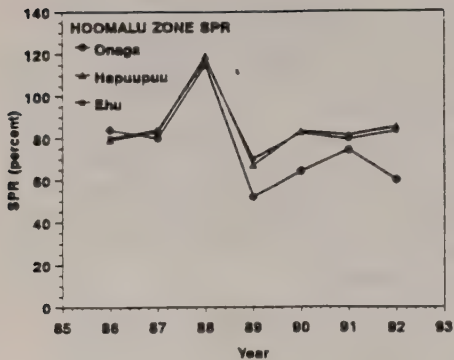


FIGURE H-18. SPR for NWHI bottomfish.

Data source: SPR estimated from Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from data reported to HDAR by commercial fishermen.

Calculation & adjustments: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu zones. Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year catch data. All values have changed from previous annual reports due to changes in the CPUE calculation (see H-14a) and lack of multiyear averaging.

Interpretation: Current SPR estimates for all six species in both zones are well above the twenty percent critical level used as an indicator of recruitment overfishing. Mau zone SPR estimates tend to be slightly lower than Hoomalu zone SPR

estimates for most species, and onaga SPR estimates tend to be slightly lower than those for most other species.

The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

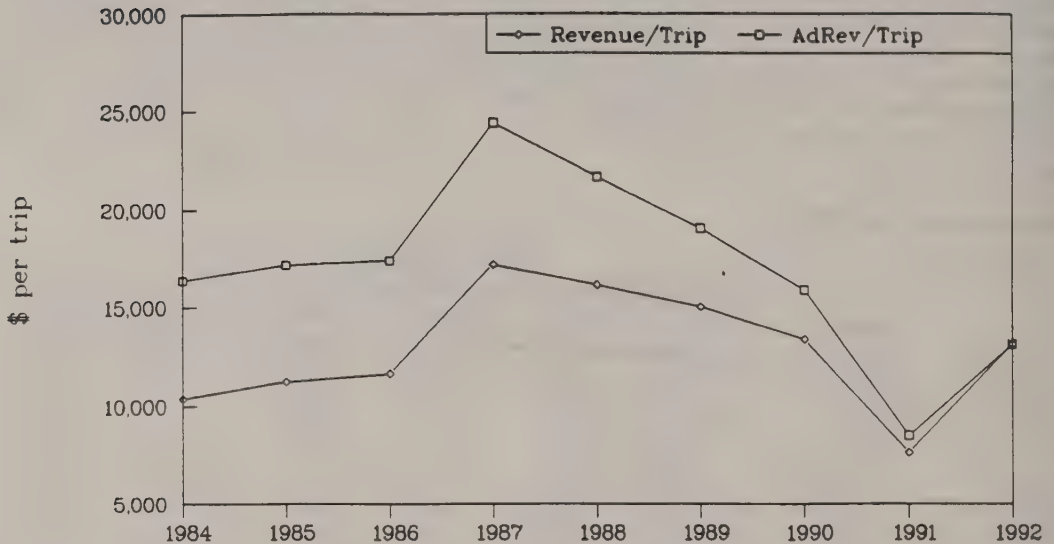
Tabulated values:

YEAR	MAU SPR (%)					
	EHU	HAPU	ONAG	OPAK	UKU	ULUA
1986	63	65	74	63	63	63
1987	40	42	33	40	40	40
1988	38	35	37	38	38	NA
1989	49	55	32	49	49	49
1990	85	96	72	81	85	85
1991	60	68	61	58	60	61
1992	36	42	38	36	36	NA

YEAR	HOOMALU SPR (%)					
	EHU	HAPU	ONAG	OPAK	UKU	ULUA
1986	80	79	84	80	79	80
1987	84	83	80	84	84	84
1988	117	119	115	117	117	117
1989	70	67	52	70	70	70
1990	82	83	64	82	82	82
1991	79	81	74	78	79	79
1992	83	85	60	82	83	83

NWHI Fleet Activity, 1984 - Present Revenue per trip

NMFS Estimates



BTTM92A

FIGURE H-19. NWHI bottomfish vessel economic performance (inflation-adjusted ex-vessel revenue), 1984-1992.

Data source: Data are compiled from the NMFS Honolulu Laboratory's shoreside monitoring program in Honolulu, supplemented by HDAR commercial catch reports for recent years.

Calculations & adjustments: The NMFS estimate of total NWHI bottomfish ex-vessel revenue (adjusted for inflation) is divided by the NMFS estimate of total NWHI bottomfish trips.

Interpretation: Although the data show a substantial decline in average ex-vessel revenue (adjusted for inflation) per trip in the NWHI, information on trip length suggests that fishing strategies have changed. In 1991 there was a relatively large amount of fishing in the Mau zone, which has a shorter overall trip length. This led to a dramatic decline in overall average revenue per trip in 1991. The "recovery" in 1992 is a reflection of this particular anomaly and the impact of Hurricane Iniki on shorter bottomfishing trips taken out of Kauai. More detailed cost-earnings assessment of the fishery is scheduled for completion this year which should give a better picture of economic conditions in the NWHI fishery.

Tabulated values:

**NMFS Trip Estimates to Northwestern Hawaiian Islands
(All Areas) 1984 to present**

Year	Trips	Revenue/Trip	Inflation- Adjusted AdRev/Trip
1984	135	10,370	16,366
1985	160	11,250	17,162
1986	163	11,656	17,395
1987	134	17,164	24,376
1988	93	16,129	21,619
1989	50	15,000	19,036
1990	80	13,375	15,850
1991	131	7,634	8,507
1992	92	13,152	13,152

Note: 1984 to 1990 compiled from NMFS shoreside monitoring. 1991 and 1992 compiled by combining NMFS and HDAR data sources.

5.4 SEAMOUNT GROUND FISH: SE HANCOCK ARMORHEAD

RESEARCH CPUE ON SE HANCOCK

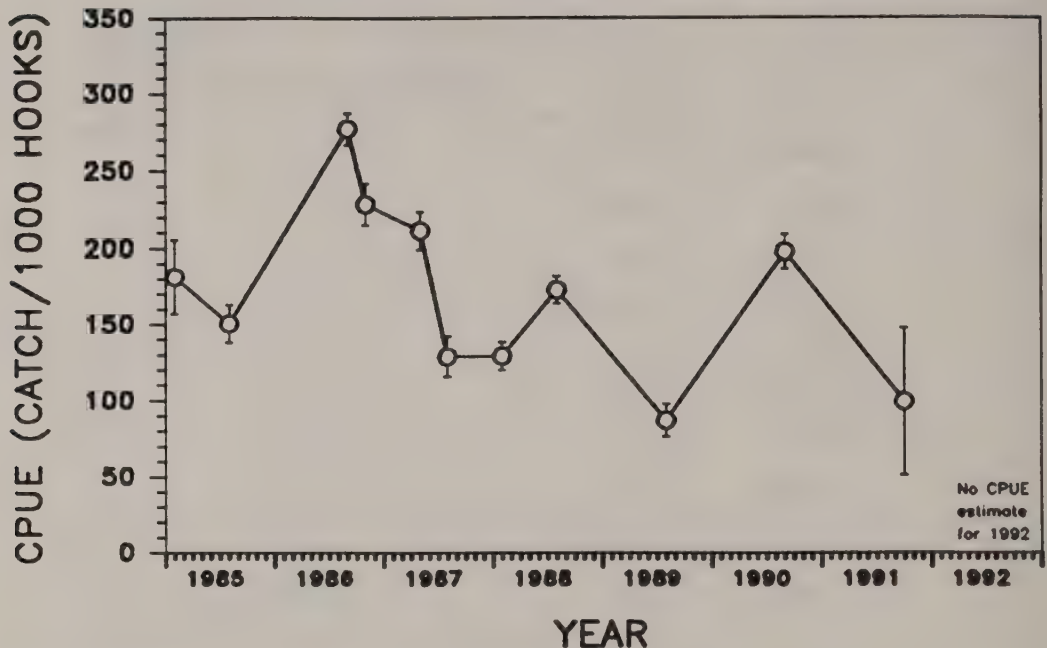


FIGURE H-20. Armorhead stock assessment.

Data source: Figure H-20 presents CPUE based on research longline catches at SE Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V Townsend Cromwell. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and therefore no CPUE estimate is available.

Calculations & adjustments: Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton (1988) and Somerton and Kikkawa (1992). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata. CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed

and applied to the catches obtained on all SE Hancock research surveys since 1985.

Interpretation: Since no assessment of the armorhead stock at SE Hancock was conducted in 1992, any change from the 1991 CPUE is unknown.

Tabulated values:

MONTH/YEAR	ARMORHEAD CPUE
=====	
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)

ARMORHEAD SPAWNING POTENTIAL

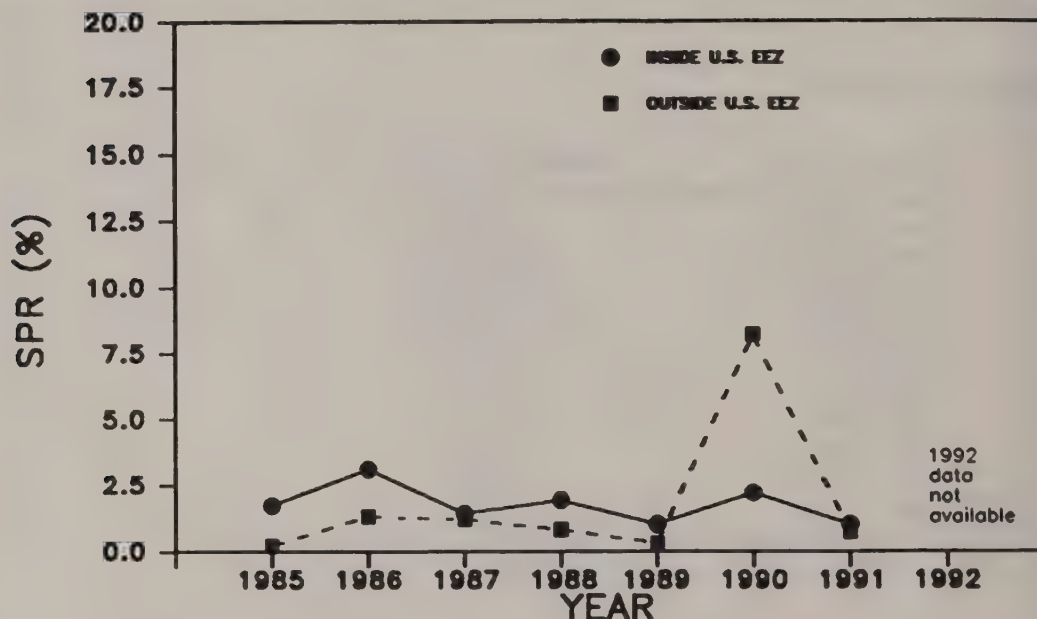


FIGURE H-21. Armorhead SPR.

Data source: SPR values for seamounts outside the U.S. EEZ are based on reported CPUE of Japanese trawlers. SPR values for seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE and trawl CPUE.

Calculations & adjustments: SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomass estimates were derived using procedures from Somerton & Kikkawa (1992).

Interpretation: SPR within the region outside of the U.S. EEZ, which historically (Japan trawl fleet during the 1969-1981 period) contributed 91% of the total catch of armorhead, is 0.7%; based on the most current (1991) available catch and effort statistics from the Japanese trawl fishery. This 1991 SPR value

indicates a marked decline from the previous year's value of 8.2%; the latter represents the first substantial increase in armorhead stocks outside the U.S. EEZ since 1978. The 1991 data for the region outside of the U.S. EEZ thus indicates that SPR has declined back to the low levels encountered during 1985-1989.

Although catch and effort data derived from the Japanese trawl fishery has yet to be received for 1992, preliminary information from colleagues from Japan suggests that catches of armorhead have increased markedly outside the U.S. EEZ. Further information on 1992 armorhead catches outside the U.S. EEZ is anticipated pending receipt of catch statistics typically issued in the fall of the following year; these data have been provided informally, and Honolulu Laboratory scientists are working to formalize the relationship with Japanese scientists.

Of particular interest is whether SE Hancock Seamount has also experienced a marked increase in armorhead abundance. Recovery of the armorhead population at SE Hancock Seamount from past over-exploitation is thought to have been hindered by the complete absence of fishery management on the seamounts outside the U.S. EEZ. Past monitoring efforts conducted by the NMFS at SE Hancock have coincided with low armorhead abundance both inside and outside the U.S. EEZ. Figure H-21 indicates that in the one year (1990) where SPR showed a marked increase outside the U.S. EEZ, SPR rose only slightly within the U.S. EEZ. One caveat, however, to any interpretation of this is that SPR is derived differently for the two regions (see Calculations & Adjustments section). Besides the 1990 event, there is no other information available to evaluate whether a resurgence of the armorhead population at the large northern seamounts connotes a similar resurgence of armorhead at the much smaller southern seamounts, which includes SE Hancock Seamount. Tentative plans for stock assessment at SE Hancock involve a NMFS research cruise in October 1993. Furthermore, discussions are underway for a cooperative U.S.-Japan research survey of armorhead throughout the southern Emperor-northern Hawaiian ridge seamounts coinciding with the October 1993 NMFS cruise. Until then, and pending effort and further catch data from outside the U.S. EEZ, the current status of the armorhead stock at SE Hancock is unknown and is assumed to remain depleted.

Tabulated values:

YEAR	ARMORHEAD SPR (%)	
	INSIDE US EEZ	OUTSIDE US EEZ
1985	1.7	0.2
1986	3.1	1.3
1987	1.4	1.2
1988	1.9	0.8
1989	1.0	0.3
1990	2.2	8.2
1991	1.0	0.7
1992	NA	NA

*see previous Interpretation Section

5.5 SUMMARY

Biological indicators for the Northwestern Hawaiian Islands (NWHI), in general, suggest a healthy fishery. Combined CPUE values for the Mau and Hoomalu zones have, however, followed a decreasing trend since 1986. With this short time series it is difficult to say whether the early years experienced exceptionally good fishing or the later years abnormally poor, indicating fishing down or overfishing, or if changes in CPUE are a result of a change in composition of the fishing fleet (particularly in the Mau zone) since the implementation of limited entry. Values of mean weight and percent immature have remained healthy and relatively stable since 1984. Hoomalu zone SPR values have remained stable whereas Mau zone 1992 values have dropped rapidly from a 1990 peak to levels similar to those of 1987-1988 (about 40%). MSY values for the combined NWHI zones have been estimated at 800,000 pounds and 1,000 fishing days per year. Landings were near or above this estimate in 1985-1987 and have dropped to about half of this level for 1989-1992. Partitioning this MSY between the two zones in proportion to the area of habitat results in an MSY of about 200,000 pounds for the Mau zone and 600,000 pounds for the Hoomalu zone.

Main Hawaiian Islands (MHI) bottomfish have been heavily fished. CPUE values have been less than half initial values for the past several years. Percent immature values have been much higher than NWHI values for all species (except hapuupuu) and have been above the 50% warning level for onaga in all years analyzed. Mean weight values for opakapaka, onaga, ehu, uku and ulua are much lower than those from the NWHI. Onaga has been consistently below its weight at maturity. SPR levels for onaga have been below the 0.20 level, defined as recruitment overfished, for the last three years. (This is the first year it has been reported below the critical level due to a change in

reporting method and the addition of two years of data). SPR values also appear low for ulua, but this is apt to be an artifact of unique fishing patterns and not a cause for alarm (Kobayashi, 1993). SPR values for opakapaka and ehu have generally been in the 30-40% range, but are not showing a declining trend indicating that the stocks are probably in equilibrium and not declining.

No fishing has been allowed on the armorhead stocks of the S.E. Hancock Seamount since the moratorium began in 1986. This moratorium has been extended to 1998. No stock assessment survey of the population was conducted in 1992, therefore any change from the previous year's CPUE estimate is unknown. Preliminary reports from Japan suggest that armorhead catches have increased outside the EEZ. A collaborative U.S.-Japan stock assessment survey for armorhead throughout its range is planned for late 1993. The current status of the U.S. EEZ stock is unknown and assumed to remain depleted.

5.6 RECOMMENDATIONS

For the NWHI, the BPT recommends that the new federal daily catch report (currently being developed) be implemented as soon as possible. Recommendations regarding possible modification of the NWHI limited entry program await the completion of the complete economic review of the fishery.

For the MHI, action must be taken to improve onaga stocks. SPR levels are reported for the first time as being below the 0.20 for the last 3 years, which by definition indicates recruitment overfishing. Appropriate options for action, that the Council has recommended to the State of Hawaii, include a three month seasonal closure for onaga, and possibly other species, or other alternative effective regulations.

Also for the MHI, the proposed regulatory measure establishing a minimum size for opakapaka should not proceed at this time. Biological indicators suggest a heavily fished, but not overfished condition, and potential release mortality of undersized fish coupled with compensatory increases in fishing mortality may negate or reverse any intended benefits.

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6.0 REPORT FROM NORTHERN MARIANAS

6.1 INTRODUCTION

The Commonwealth of the Northern Marianas Islands (CNMI) bottomfish fishery occurs primarily around the islands of Saipan, Tinian, Rota, Farallon de Mendilla, Anatahan and Aguigan. However, this report is limited to catches landed in Saipan, which is by far the largest market. The CNMI's bottomfish fishery consists primarily of small-scale local boats engaged in commercial and subsistence fishing. The bottomfish fleet consists primarily of vessels less than 24 feet in length which are generally limited to a 20-mile radius from Saipan. The larger vessels are able to fish extended trips, sometimes traveling as far as Pagan. Deepwater (500-700 feet) commercial fishing targets onaga and other high-value snappers, whereas trips targeting shallow water (100-500 feet depths) species, such as emperors, can be subsistence or commercial. It is assumed that hand lines, home fabricated hand reels, or electric reels are the only gear utilized for the bottomfish fishery. Historically, some bottomfishing trips frequently lasted more than one day. Currently however, effort is defined and calculated on a daily trip basis. Fishing trips are generally restricted to daylight hours with all vessels returning before or soon after sunset. Bottomfishing commands more skill than pelagic trolling and requires knowledge on the location of specific submerged bottom features and hooking techniques. Presently, bottomfishing can still be described as "hit or miss". Without fathometers and even nautical charts the majority of fisherman fish randomly, often relying on land features for navigation. This type of fishing is very inefficient and usually results in a low CPUE when compared with pelagic trolling. Of the approximate 37 bottomfishermen, only 8 presently use fathometers.

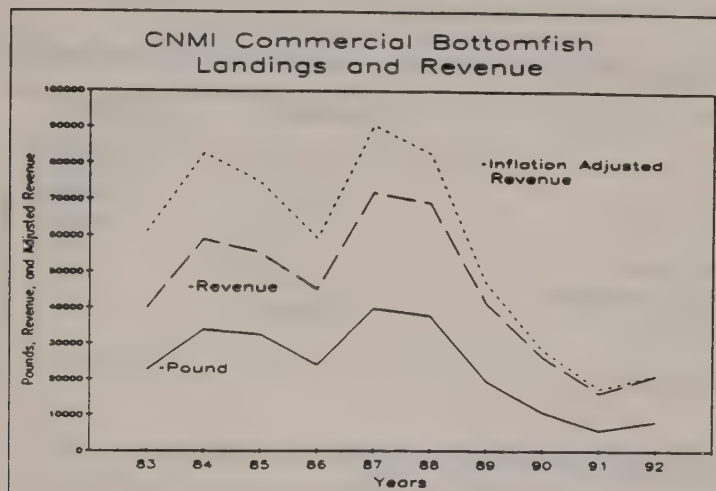
This report characterizes the fishery from data collected through the Commercial Purchase Data Base, which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon the accurate recording by first-level purchasers of all fish by species on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collect and distribute invoice books to more than 60 participating local fish purchasers; which include practically all fish markets, stores, restaurants, hotels and roadside vendors ("fish mobiles"). This data collection system will be extended to Rota and Tinian beginning in May 1993. Commercial Purchase data receipt forms for these two islands have recently been printed and are ready for distribution. Although this data collection system has been in operation since the mid-1970's, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fisheries. Because additional editing was conducted

during 1992, some corrections from last year's annual report are included. These corrections of the 1991 data are indicated in Figures 1, 2 and 3. Although this database lacks information concerning fishing methodology, location and fishing effort, the Offshore Port Sampling Survey provides additional data required for further analysis. This Survey has recently been improved through the addition of two extra personnel, data sheet modifications, and an increase in effort with respect to field sampling. NMFS Honolulu Laboratory scientists recently finalized the computer programs necessary to calculate an estimate of total landings and effort by method. Historical port sampling data are presently being computerized by DFW staff. These data will be ready to process and make appropriate expansions in the near future.

With the recent DFW possession of a fifty foot "Picket" boat from the military surplus and purchase of additional fishing gear, the Division will resume its bottomfishing training program in May. This training program is still being requested by a number of interested fishermen. With this 50 foot boat, the Division will be able to take larger numbers (6-9) of participants on each training trip.

6.2 DISCUSSION OF DESCRIPTORS

FIGURE NM-1. CNMI commercial bottomfish landings and revenue.



Summary of annual data

<u>Year</u>	<u>Pounds</u>	<u>Revenue</u>	<u>Adjusted Revenue</u>
1983	22683	40003	66005
1984	33924	59005	89688
1985	32780	55396	80878
1986	23929	45079	64012
1987	39772	71868	97740
1988	37850	69052	89768
1989	19550	41379	50482
1990	10903	26323	30798
1991	5693	16118	17407
1992	8148	21032	21032

Calculation: Landings in pounds are from a simple data base summation of reported purchases of all bottomfish species combined. Revenue in dollars is from the same type of data base summation of the value field. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1992 CPI figure as the basis by which calculations of previous year's prices are made.

Interpretation: Landings, revenues and adjusted revenues for 1992 have slowly increased and are still increasing into 1993. The increase may be attributed to the slight increase in bottomfishing participation (Figure 2 and 3), particularly with

the beginning of a new bottomfishing business venture that began its operation in the last quarter of 1992. Another factor may be the increased utilization of electronic devices, such as fathometers.

TABLE NM-1. CNMI 1992 commercial landings of bottomfish species.

SPECIES	POUNDS	REVENUE	\$/LB
Jacks	269	729	2.71
Bottomfish*	4448	10828	2.43
Grouper	1418	4250	3.00
Onaga (red snapper)	17	102	6.00
Opakapaka (pink snapper)	109	270	2.47
Emperor (mafuti)	1886	4854	2.57
Bottomfish Totals:	8148	21032	2.58 (average)

* - denotes miscellaneous or non-identified species.

Calculation: Annual summaries for each species from invoice data sheets. Note: During 1992, the number of vendors increased dramatically along with the collection effort. There are presently more than 38 participating local bottomfish fishermen (boats) compared to the approximate 20 that were recorded during 1991.

Interpretation: Unfortunately, 54% of all 1992 bottomfish landings were not identified by species groups and any interpretations based on the above data would be highly questionable.

The deep water bottomfish Onaga commanded the highest price per pound (\$6.00), while the shallower water bottomfish (e.g., groupers, emperor) ranged from \$2.43 to \$3.00 per pound.

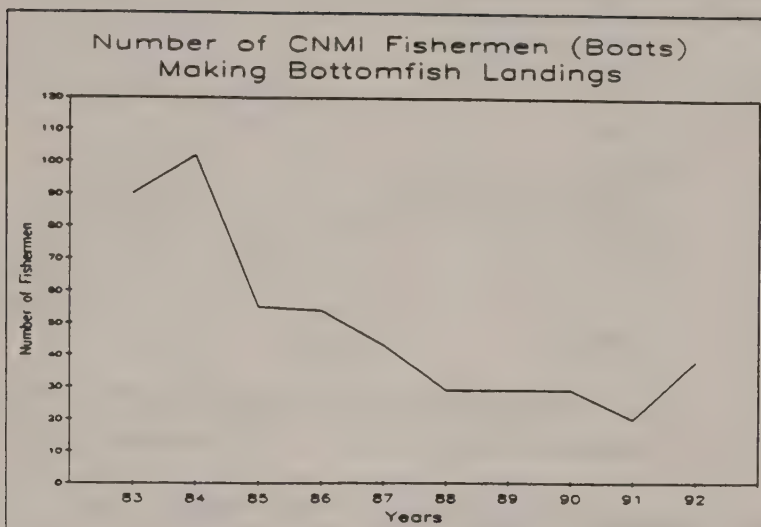


FIGURE NM-2. Number of CNMI fishermen (boats) making bottomfish landings.

Summary of annual data

<u>Year</u>	<u>Number of boats</u>
1983	90
1984	102
1985	55
1986	54
1987	42
1988	29
1989	29
1990	29
1991	20
1992	38

Calculation: The fisherman or boat selling the catch is identified on the "trip ticket" invoices used by purchasers. The plot shows the number of unique fishermen making any landings of bottomfish within a given year.

Interpretation: As with the number of trips (Figure 3), the number of boats or fishermen making commercial landings of any bottomfish species declined from 1984 to 1988, stabilized between 1988-90, and slightly increased during 1992.

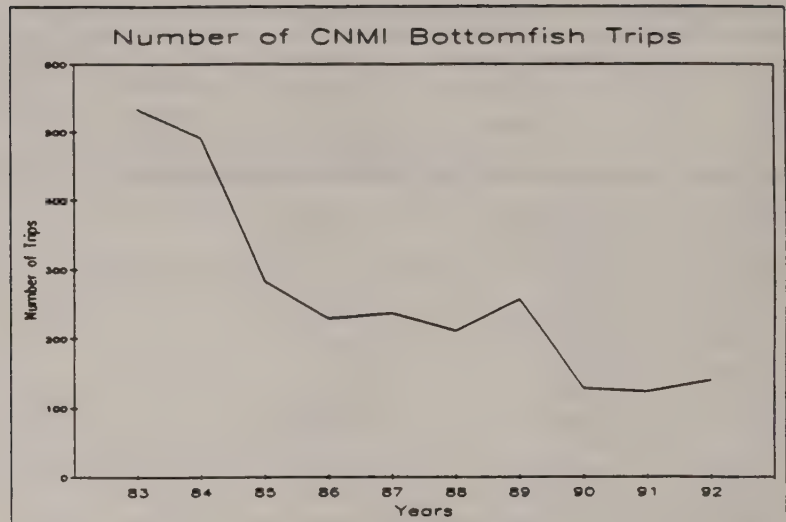


FIGURE NM-3. Number of CNMI bottomfish trips.

Summary of annual data

<u>Year</u>	<u>Trips</u>
1983	533
1984	492
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129

Calculation: The number of trips which resulted in landing any amount of any bottomfish species are tallied by adding each recorded trip per day. The assumptions are that each fisherman lands only once in a given day, and that he sells all of his catch on that day. Most trips are a single day in length.

Interpretation: The slight increase in the number of bottom-fishing trips taken by the CNMI fleet is probably a result of most effort being directed toward pelagic trolling. As in last year's report, many of the newer fisherman are still re-directing effort toward the tourist industry, where greater revenues may be possible with relatively fewer problems. U.S. Coast Guard licenses were still actively being issued on Saipan during 1992, which further indicates the continued interest in tourist related boat operation. A U.S. Coast Guard license is required for any vessel operator who carries passengers for hire (i.e., tourists).

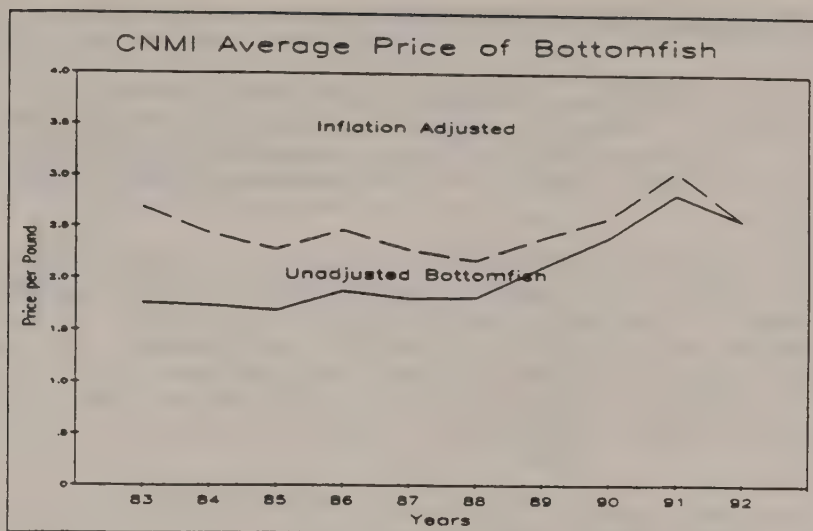


FIGURE NM-4. CNMI average price of bottomfish.

Summary of annual data

<u>Year</u>	<u>Unadjusted \$/LB</u>	<u>Adjusted \$/LB</u>
1983	1.76	2.91
1984	1.74	2.64
1985	1.69	2.47
1986	1.88	2.68
1987	1.81	2.46
1988	1.82	2.37
1989	2.12	2.58
1990	2.41	2.82
1991	2.83	3.06
1992	2.58	2.58

Calculation: The average price of the bottomfish complex is calculated by dividing the total revenue by the total landings. The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1992 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate CNMI agency and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Interpretation: The average price per pound increased steadily from 1988 to 1991, to a high of \$2.83. In 1992 the price dropped to \$2.58 due to low landings of high priced Onaga and Opakapaka, while market demand remained constant and bottomfish availability was inconsistent.

6.3 ANALYSIS OF INDICATORS

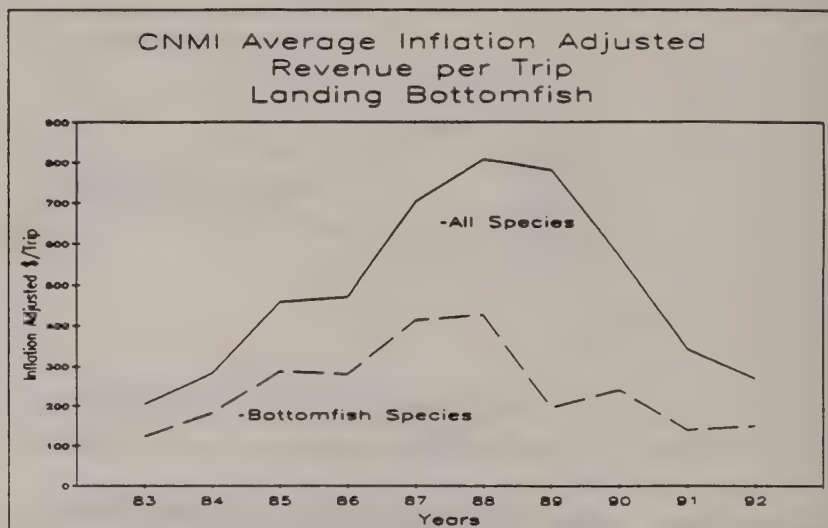


FIGURE NM-5. CNMI average inflation adjusted revenue per trip landing bottomfish.

Summary of annual data

Year	Bottomfish species		All species	
	Unadjusted	Adjusted	Unadjusted	Adjusted
1983	75	124	124	205
1984	120	182	186	283
1985	196	286	314	458
1986	197	280	330	469
1987	303	412	517	703
1988	327	425	621	807
1989	161	196	639	780
1990	204	239	485	567
1991	130	140	316	341
1992	150	150	268	268

Calculation: Only trips which landed any bottomfish species are included in these calculations. The "Bottomfish \$/Trip" is the total revenue of the bottomfish species sold from a trip, and the "All Species \$/Trip" is the total trip revenue of all species combined (including pelagic and reef fish which were sold). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 1992 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983-87 were not available from the appropriate CNMI agency and

were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Interpretation: In general, inflation adjusted bottomfish revenues increased slightly in 1992 following a decline in 1991. The trend for inflation adjusted revenues for all species continued to decline, but not as rapidly as between 1989 and 1991.

The actual difference in price for inflation adjusted bottomfish revenue increased when compared with 1991. On the other hand, inflation adjusted revenue for all species continued to decreased in 1992. Demand for bottomfish entering the market was similar to 1991 and reduced landings of high priced Onaga and Opakapaka may have been responsible for the decreased revenues (lower price per pound generated by the somewhat constant valued species).

Overall, bottomfish comprised an ever decreasing portion of the total landings from fishing trips until 1990, when the difference lessened. The bottomfish fishery has always comprised a small proportion of the total fisheries, however it appears that bottomfish comprise a relative higher percentage of the trip revenue.

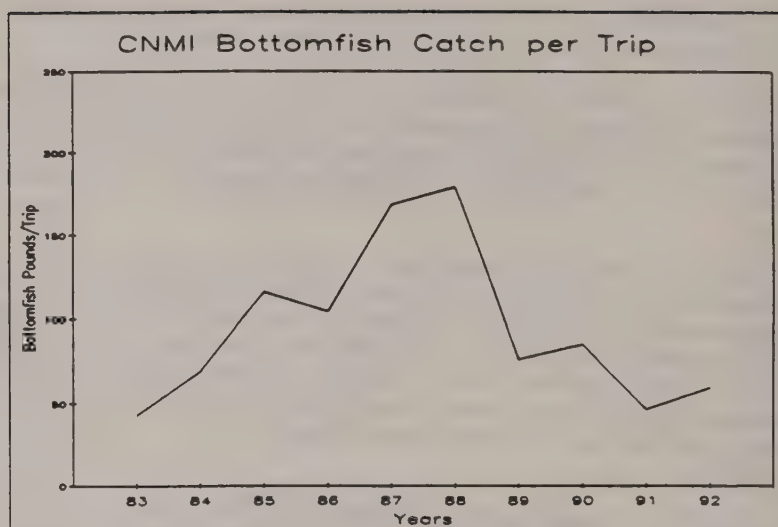


FIGURE NM-6. CNMI bottomfish catch in average pounds per trip.

Summary of annual data

<u>Year</u>	<u>Pounds per trip</u>
1983	43
1984	69
1985	116
1986	104
1987	168
1988	179
1989	76
1990	85
1991	46
1992	58

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips which landed bottomfish, regardless of the amount of bottomfish landed on any given trip. Although the average catch per trip is a poor measure of CPUE due to significant biases (e.g., variations in trip length and relative amounts of time spent bottomfishing versus trolling), it is the only measure readily possible from the commercial landings system. It may be possible to improve this measure of CPUE by using only those trips which landed bottomfish species exclusively, but that has yet to be done. The sample size from such an exercise would be extremely small and incur other biases, however, it is worth investigated in the future.

Interpretation: Even though bottomfishing effort and landings are slightly higher in 1992, revenues obtained from sales are relatively stable. This may be a function of fishermen trolling to/from the bottomfishing site, thus having a mixed catch after spending the "day bottomfishing".

6.4 SUMMARY

Bottomfish fishing in the CNMI has stabilized from its previous decline, but has not recovered nor shown any significant growth. This stabilization could lead to growth in the fishery as suggested by the overwhelming interest in the SPC/DFW bottom longline training project that was indicated in last year's report recommendations. Domestic U.S., joint-venture, and foreign vessels are still inquiring about full-time bottomfishing in CNMI waters. The impact to the commercial market is presently unknown. During 1992 charterboat activities and impacts on local fish markets were investigated. A system of collecting CPUE data (shallow bottom) for the charterboat catches was implemented and data were collected regularly.

Revenues and prices will most likely increase with renewed fishing interest, despite the slight decrease that occurred in 1992. Deepwater snapper still command the highest prices. Fishermen utilizing larger vessels have greater access to snapper; the market for them should improve as well, providing consistent supply and quality. With the recent acquisition by DFW of a fifty foot picket boat (from military surplus), and further training of its staff in proper fish handling techniques (from a recent SPC workshop), the much needed bottomfishing training to interested fishermen should resume by May 1993. Specifically, this training should address proper operation and/or interpretation of fathometers and nautical charts, electric reel repair, anchoring techniques, post-harvest handling, and marketing.

With the planned expansion of biological data collection from the bottomfish fishery, improved understanding of the bottomfish stocks surrounding Saipan can be developed. After identifying the extent of resource utilization further data collecting should be helpful in determining management strategies.

6.5 RECOMMENDATIONS

The CNMI Division of Fish & Wildlife strongly recommends that the Council support its much needed bottomfishing training program. Because it has become more difficult for fishermen to catch bottomfish through traditional means of fishing randomly and using landmarks for crude location of fishing sites, a training program that will address and correct these problems should significantly benefit CNMI's bottomfish industry. This training should also focus on the proper usage of electronic devices such as fathometers, chart plotting and on proper anchoring.

7.0 APPENDICES

7.1 APPENDIX 1: NMFS ADMINISTRATIVE ACTIVITIES

NWHI Limited Entry Program

During 1992, the NMFS Southwest Region issued a total of 35 fishing permits for the Northwestern Hawaiian Islands (NWHI) bottomfish fishery. This was one less than the 36 permits issued in 1991, the highest number issued since the limited access program went into effect in 1988. During 1992, 30 vessels held Mau (qualifying) Zone permits, of which 21 were renewals and 9 were new entrants into the fishery. Although the number of permits for this zone remained essentially the same as in the previous year, there was a 30 percent change (9 vessels) in entry to and exit from the Mau Zone fishery.

Five vessels were issued Ho'omalulu (limited access) Zone permits, one less than the number of permit holders in 1991.

Ho'omalulu Zone (limited access) vessels:

Anna Riley
E.T.
Fortuna
Kaimi Kai
Laysan

Mau Zone (qualifying) vessels:

Aikane 49	Imua	Liberty
Angel Fish (new)	Iwalani (new)	Lisa I
Blue Sky	J-Natsuko-O	Mavis
Cruiser (new)	Janel-O	Sea Eagle
Dasher II	Jenine	Sea Latch (new)
Dynamic (new)	Kai Ola	Seung Ri Yi
Goldstar	Kasatka (new)	Spirit
Halfmoon Bay	Kathy B	Windwalker
Holokai (new)	Kuma (new)	Honua-Oe
Lei Alana	Ia Orana	Lea Lea (new)

7.2 APPENDIX 2: NMFS 1992 ENFORCEMENT ACTIVITIES

During 1992 NMFS agents accompanied ten USCG C-130 patrols along the Northwestern Hawaiian Islands. No violations were documented during these flights.

There were no substantiated reports or detection of illegal gear or fishing methods in the NWHI.

No violations of the reporting requirements have been documented.

The NMFS Law Enforcement Division has received very few complaints, and have not substantiated any violations of the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region.

7.3 APPENDIX 3: PROTECTED SPECIES/HABITAT CONDITIONS

Protected Species

During calendar 1992, NMFS observers were placed aboard bottomfish vessels for 13 cruises. During this period the fleet consisted of 35 permitted vessels, of which 13 vessels were active at any one time. A total of 78 notifications were received for bottomfishing trips to the NWHI. Observer coverage for vessels fishing in the Mau Zone was 6 trips of 42, and for the Ho'omalulu Zone 7 trips of 36.

Interactions were defined as events during which fish or bait were stolen or damaged by marine mammals or sea birds, or when marine mammals, sea turtles or sea birds were hooked or entangled in gear. For the 13 trips, interactions with marine mammals were observed on 2 of 6 trips to the Mau Zone and 5 of 7 trips to the Ho'omalulu Zone. During a total of 677.8 hours of fishing effort during the 13 trips, 18 Hawaiian monk seal (Monachus schauinslandi) and 29 bottlenose dolphin (Tursiops truncatus gilli) interaction events occurred. This resulted in an observed interaction rate of one monk seal interaction for every 37.7 hours of fishing, and one bottlenose dolphin interaction for every 24.2 hours of fishing. These interactions may have involved one or more individual animals during each event. The combined rate for all marine mammal interactions was one event for every 14.4 hours of fishing effort. A total of 132 fish (most of which were commercially valuable) were observed either damaged or lost to seals and dolphins, but many more were likely taken below the surface and could not be seen.

There were no observed or reported injuries to or mortalities of Hawaiian monk seals or bottlenose dolphins as a result of these interactions. No interactions with sea turtles were observed. A few sea bird interactions were reported with only one injury and no mortalities.

Flesh samples of kahala (Seriola dumerili) were collected to test for the presence of ciguatoxin in these fish from different areas in the NWHI. The samples are being analyzed by the NMFS Charleston Laboratory.

Habitat Conditions and Recent Alterations

Under the bottomfish FMP, regulations were implemented to prohibit the use of bottom trawls, bottom-set nets, explosives and poisons for harvesting bottomfish. This has served to greatly reduce the potential for bottomfish habitat degradation. To our knowledge, there have been no violations of these regulations in 1992.

As reported in earlier annual reports, there are several activities occurring, or reportedly occurring, in the EEZ that may potentially alter bottomfish habitat. These include:

1. Anchor damage by vessels attempting to maintain position over productive bottomfish habitat.
2. Habitat damage from heavy weights and line entanglements during normal hook-and-line bottomfish operations.

An activity which potentially may impact bottomfish habitat is a proposal to lease 26,910 square kilometers of the EEZ surrounding the Hawaiian Archipelago and Johnston Island for mining of cobalt rich manganese crusts. A joint State-Federal Task Force, which includes a staff member from the NMFS Habitat Conservation Program, has developed an environmental impact statement (EIS) for the proposed activity.

Two powerful hurricanes struck the U.S. Pacific Islands during 1992. In August Hurricane Omar devastated Guam. In September Hurricane Iniki did similar damage to the island of Kauai. Both hurricanes did substantial damage to coral reef habitat, the extent of which is still being assessed. In addition, many vessels, including fishing vessels, were sunk in harbors as well as at sea. Hurricane impacts may have had adverse effects on bottomfish habitats, particularly shallow juvenile habitat.

The potential threat to bottomfish habitat is reviewed through the Council's Ecosystems and Habitat Committee. The Council has adopted a Habitat Policy which will assure that each fishery management plan includes all available information on habitat significant to the species being managed.

7.4 APPENDIX 4: BOTTOMFISH PLAN TEAM MEMBERSHIP

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